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Final Environmental Impact Statement

For the Management of the Red-cockaded Woodpecker and its Habitat on National Forests in the Southern Region

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Final Environmental Impact Statement

For the Management of the

Red-cockaded Woodpecker and its Habitat

On National Forests in the Southern Region

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PREFACE

What is an Environmental Impact Statement (EIS)?

The National Environmental Policy Act of 1969 (NEPA) requires Federal agencies considering activities that could have environmental consequences to:

- Disclose Federal actions and their environmental effects.
- Help public officials to make decisions based on understanding of environmental consequences and take actions that protect, restore, and enhance the environment.

NEPA established the EIS as the basic disclosure and action-forcing device to help public officials make well informed decisions.

An EIS discloses to the public and decision maker the environmental effects of major federal actions which are under consideration. The decision maker will choose the proposed action, an alternative action, or no action, based on the information in the EIS.

Although documents such as an EIS are the means which NEPA uses to assure that public agencies evaluate the environmental effects of their decisions, their purpose is not to generate paperwork--even excellent paperwork--but to foster excellent action.

How is the EIS organized?

This EIS is divided into seven chapters and follows a slightly modified format established by the Council on Environmental Quality (CEQ).

Chapter 1 describes the strategy developed by the interdisciplinary team (**Proposed Action**), why the strategy is needed (**Purpose of and Need for the Proposal**), and the issues generated by public comments and internal review (**Issues and Public Involvement**).

Chapter 2 describes in detail and compares the proposed action and alternatives including no action. These alternatives to the proposed action address the significant issues generated in Chapter 1.

Chapter 3 describes the affected environmental (**Present Conditions and Effects of Past Actions**) and the direct, indirect, and cumulative effects (**Environmental Effects**) of each alternative on a particular resource identified in the Issues section of Chapter 1. Chapter 3 streamlines and clarifies how a particular resource (significant issue) has been affected by past actions and how the various actions under consideration would affect this resource in the future.

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SUMMARY

Introduction

The red-cockaded woodpecker (Picoides borealis) is slightly larger than a bluebird, about seven inches long. In the field it appears black and white with a large white cheek patch. The sexes are identical except the male has a small tuft of red feathers, the cockade, located above the eye at the top of the cheek patch. The cockade is inconspicuous and is rarely seen in the field (Hooper et al. 1980).

The red-cockaded woodpecker (RCW) is a nonmigratory species and once commanded a wide range throughout the pine belt of the Southern United States, extending from Missouri, Kentucky, and Maryland; southward to Florida, and westward to eastern Texas.

The RCW was first listed as an endangered species in 1970. The primary reason for the RCW's decline in numbers can be presumed from historic accounts of the settling of the South and subsequent clearing of the Southern forest. The RCW is most frequently associated with the longleaf pine forest type but is also found in loblolly, slash, shortleaf, pond, and Virginia pine. By the 1930's most of the South's pine forest had been cut over. RCW populations probably declined dramatically as the pine forest disappeared.

The current range of the RCW is limited and fragmented. The largest remaining RCW populations exist on the National Forests extending along the Coastal Plain from North Carolina to Texas, the Piedmont of Georgia and Alabama, and into the interior highlands of Arkansas, Oklahoma, Tennessee, and Kentucky.

The RCW is unique in that it is the only woodpecker which exclusively uses living pine trees in which to excavate its cavities (USDI Fish and Wildlife Service 1985). They also tend to select trees infected with a heartwood decaying fungus Phellinus pini (Jackson 1977, Conner and Locke 1982, Hooper et al. 1991, Rudolph and Conner 1991, Conner et al. 1994). Heartrot is not commonly found in longleaf pine until around 100 years of age and not in loblolly until about 75 years (Wahlenberg 1946, Wahlenberg 1960), therefore most RCW cavities are found in older mature pines. The RCW prefers open, park-like pine stands with very little midstory vegetation.

This document, as suggested by Walters et al. (1988b), will refer to the area (minimum of 10 acres) surrounding aggregates of cavity trees as clusters, and RCW family units as groups. This is different from much of the literature, including the red-cockaded woodpecker recovery plan and all existing National Forest System RCW management direction, which refer to the aggregate of cavity trees as colonies or colony sites and the RCW family units as clans.

The Proposed Action

The Forest Service proposes to revise the Regional Wildlife Habitat Management Handbook (Handbook), amend the Southern Regional Guide (Regional Guide), and amend affected Forest Plans with new management direction for the endangered RCW. The proposed action has several elements and levels of implementation. The revised Handbook/Regional Guide Amendment (Revised Handbook) would establish criteria to delineate RCW Habitat Management Areas (HMAs) and determine population objectives and establish standards and guidelines for management within HMAs. This direction would not be implemented upon issuance of the Record of Decision (ROD) for this Environmental Impact Statement (EIS), however. Rather the direction would require each affected Forest to incorporate the direction into its forest plan through amendment or revision. It is expected that amendment or revision would occur within 1 to 3 years of the issuance of the ROD.

Because of the time lag between the Handbook revision/Regional Guide amendment and the individual Forest Plan amendments or revisions, the Forest Service also proposes to amend the relevant Forest Plans through the Record of Decision for this EIS to designate tentative HMAs. The Forest Plan amendments designating tentative HMAs would require specific management practices to conserve the RCW and avoid jeopardy to the species. The tentative HMAs and accompanying direction (Immediate Action) would remain in place until superseded by the individual Forest Plan amendments or revisions to Incorporate the revised Handbook/Regional Guide direction.

The proposed new Regional direction would apply an ecosystem management approach, at the landscape level, focusing on restoration of the habitat conditions under which the RCW evolved and to the degree practicable. The new RCW management direction would be Implemented on National Forest System lands and would not apply to other Federal, state, or private lands.

Elements of the Proposed Action

The proposed action contains two elements and various activities within each element. These activities are summarized in Chapter 1 (Purpose and Need) and presented in full detail in Chapter 2 (Alternatives Including the Proposed Action). The current condition of the environment and environmental effects of the proposed action and other alternatives are described in Chapter 3.

The Forest Service proposes to:

(1) Revise the Regional Wildlife Habitat Management Handbook, FSH 2609.23R (Handbook) and amend the Southern Regional Guide to incorporate the revised Handbook through the Record of Decision (ROD). The revised Handbook and revised Regional Guide would provide new Regional direction for managing the red-cockaded woodpecker and its habitat. This direction would not be implemented until the National Forests with RCW populations have individually amended or revised their Forest Plans. This would occur within one to three years after the signing of the ROD. The revised Handbook would:

- o Establish criteria to delineate RCW Habitat Management Areas (HMA) and determine population objectives to ensure demographic stability. Approximately 2 million acres would be included within HMAs.
- o Establish four Management Intensity Levels (MILs), which are based on the risk of extirpation (local extinction) faced by the RCW population in the HMA. The risk categories are determined based on population size and trend. This "variable assist" approach to RCW recovery increases the level of habitat protection and management for high-risk populations.
- o Emphasize the use of artificial cavities and the moving of RCW from area to area (translocation) to speed population expansion and eventual recovery of the species.
- o Establish minimum rotation lengths ranging from 70 to 120 years depending on the species of pine being managed. Habitat Management Areas would produce woodpecker habitat and timber products on a sustained-yield basis.
- o Emphasize thinning to reduce southern pine beetle risk, enhance RCW habitat, and improve forest health.

- Emphasize prescribed fire, including growing season burns, to control midstory vegetation in the pine and pine-hardwood forest types throughout HMAs, especially within clusters.

- Establish criteria to assure adequate foraging habitat (6,350 pine trees greater than 10" diameter, 30 years old or older and at least 8,490 square feet of basal area in pine stems larger than 5 inches within 1/2 mile of and connected to the clusters).

- Permit a wide range of regeneration methods. Use of various silvicultural practices would be based on balancing current RCW habitat needs with existing stand condition, site quality, and regeneration of the forest which will provide future habitat.

- Limit regeneration of the oldest 1/3 of pine and pine-hardwood acres until they reach rotation age. This will ensure suitable potential cavity trees in the shortest time.

- One exception to protecting the oldest 1/3 would be where it would be desirable to regenerate part of the oldest 1/3 to ensure sustained flow of RCW habitat through time. Any harvest must occur in the youngest end of the oldest 1/3 and only when this Is within 10-20 years of rotation.

- Encourage restoration of longleaf and other desirable pine species in areas where they occurred historically which would provide better habitat for the RCW and improve forest health.

- Establish monitoring requirements to determine if the objectives of the new RCW management direction are being met.

- Require monitoring intensity to be linked to population and vulnerability of the RCW population to extirpation.

- Include implementation, effectiveness, and policy validation monitoring.

(2) Immediately amend 11 Forest Plans through the Record of Decision (ROD) to identify and delineate tentative RCW Habitat Management Areas totaling approximately two million acres and identify tentative population objectives (see Table S-1). The affected National Forests where RCW occur are: Alabama, Chattahoochee-Oconee, Cherokee, Daniel Boone, Croatan and Uwharrie, Florida, Francis Marion, Kisatchie, Mississippi, Ouachita, and Texas. The ROD would also establish an implementation time line for the National Forests to amend or revise their Forest Plans to incorporate the specific elements of the Regional direction.

Tentative HMAs would Included suitable RCW habitat between the 3/4-mile radius circles around active and inactive clusters currently protected by Interim S&Gs. Interim S&Gs will remain in effect within the 3/4-mile radius circles until individual Forest Plans are amended/revised to incorporate the new RCW Regional direction--one to three years.

Table S-1
Tentative Habitat Management Areas (HMA) and Population Objectives.
Tentative HMAs are based on the distribution of existing active and inactive clusters (colony sites), rather than the current RCW population.

STATE	National Forests with HMAs (RECOVERY POP. UND)	Tentative HMA Area (Acres)	Population 1994	Tentative Pop. Objective
			———(Active Clusters)———	
ALABAMA	Bankhead	20,402	0	68
	Conecuh	61,817	14	309
	Talladega-Oakmulgee Rd	98,584	120	394
	Talladega/Shoal Creek Rd	124,247	4	413
		305,050	138	1,184
ARKANSAS	Ouachita	68,521	15	228
FLORIDA	Apalachicola-			
	Apalachicola RD	141,263	500	706*
	Wakulla RD	144,368	150	722*
	Ocala	48,400	4	242
	Osceola	98,183	45	462
		432,214	699	2,132
GEORGIA	Oconee/Hitchiti **	52,968	16	176**
KENTUCKY	Daniel Boone	48,487	3	66
LOUISIANA	Kisatchie-			
	Catahoula RD	65,734	27	328
	Evangeline RD	46,298	52	231
	Kisatchie RD	59,267	69	296
	Vernon RD	64,243	186	321
	Winn RD	56,297	18	281
		291,839	352	1,457
MISSISSIPPI	Bienville	125,160	92	500
	DeSoto-			
	Biloxi RD	38,293	5	191
	Black Creek RD	35,467	1	177
	Chickasawhay RD	100,494	4	502*
	Homochitto	67,755	27	225
		367,169	129	1,595
N.CAROLINA	Croatan	27,940	55	139
S.CAROLINA	Francis Marion	125,351	371	625*
TENNESSEE	Cherokee	6,150	1	n/a
TEXAS***	Angelina/Sabine	66,286	42	329
	Davy Crockett	65,016	38	325
	Sam Houston	105,194	149	525*
		236,496	229	1,179
SOUTHERN REGION		1,962,183	2,008	8,781

* These populations can be declared recovered (MIL1) when they reach 500 active clusters and meet all other criteria needed for recovery.

** The Oconee NF is combined with Hitchiti Experimental Forest and Piedmont National Wildlife Refuge by Memorandum of Understanding (FSM 2609.23). The figures listed, however, show only the National Forest acreage and population objectives.

*** The National Forests in Texas are currently managed under a court order, which will remain in effect until the order is removed or a new order is issued by the District Court.

Within the tentative HMAs, but outside the 3/4-mile radius circles, Forest Plan standards and guidelines for the general forest area will remain in effect, except only thinning, irregular shelterwood (two-aged), single-tree and group selection (uneven-aged) methods would be allowed. Clearcutting (even-aged) method could be used to restore longleaf or other pine species desirable to RCW on sites currently occupied by another species of pine. If a Forest chooses to begin restoration during the transition period between the signing of the ROD and their Forest Plan amendment or revision, the Forest must first identify sufficient recruitment stands and foraging habitat to meet their tentative population objectives identified in Table 2-E1 of this FEIS.

The primary regeneration methods proposed (two-aged and uneven-aged) retain relatively high basal area and canopy cover, which will preserve future management options until the time when the new RCW Regional direction can be fully implemented through Forest Plan amendments or revisions.

Regardless of alternative selected the National Forests in Texas present a special case, remaining under a court-ordered RCW management plan. The Forest Service submitted the Interim Standards and Guidelines for Protection and Management of RCW Habitat within 3/4 Mile of Colony Sites (Interim S&Gs) to the court for its approval, but the District Court rejected them because they included even-aged management. The Forest Service will submit the revised Handbook (based on the chosen alternative) to the court. Until the court decides whether to approve this or some other management strategy, the court-ordered plan remains in effect.

Decisions to be Made

The Regional Forester will decide how the Forest Service will manage National Forest System lands where RCWs presently live to conserve and avoid jeopardizing the species.

The decisions to be made are:

(1) Whether to amend the Regional Wildlife Management Handbook and Regional Guide to establish new Regional direction for the management of the RCW.

(2) Whether to amend immeidately the Forest Plans on all National Forests with RCW to identify and delineate tentative Habitat Management Areas (HMAs) and implement specific forest management activities within these tentative HMAs.

The Issues

The following issues were identified through scoping for the Draft Environmental Impact Statement and the scoping for the Interim S&Gs. The issues are phrased as questions.

(1) Would the proposed action and alternatives that do not prohibit clearcutting and other even-aged management cause habitat loss or fragmentation, or draw the birds into trees subject to high mortality due to lightning and windthrow, and cause RCW populations to decline?

(2) Would the proposed action and alternatives cause a decline in habitat quality or affect populations of other Proposed, Endangered, Threatened or Sensitive (PETS) species such as the Louisiana pearlshell mussel, Louisiana black bear, and bald eagle?

(3) How would the proposed action and alternatives affect mast-dependent species, such as deer, turkey, and squirrel?

(4) How would the proposed action and alternatives that extend minimum rotation ages (beyond 70 years) and specify foraging habitat requirements cause changes in timber volume available for harvest, timber-related jobs, and Federal payments to states?

(5) How would the proposed action and alternatives cause changes in the costs of production and contribute to below-cost timber sales?

(6) How would the proposed action and alternatives limit access to National Forest System lands for the purpose of oil and gas exploration and development?

(7) How would the proposed action and alternatives affect use and construction of recreation facilities and trails?

(8) How would the proposed action and alternatives which allow southern pine beetle control in wilderness to protect RCW groups or their foraging habitat, affect wilderness attributes and use?

(9) Would the proposed action and alternatives cause potential degradation of air quality?

The Alternatives Considered

Each alternative presents a different scenario for managing the RCW and its habitat on National Forest System lands. All alternatives meet the needs of the RCW, to some degree, while providing varying amounts of other goods and services from the areas being managed. In addition to the preferred alternative, the following alternatives were analyzed in detail. Table S-2 compares alternatives by key RCW management activities.

ALTERNATIVE A (NO ACTION)

This alternative would continue the implementation of Interim S&Gs as the new regional RCW management direction. The alternative is described in detail in Chapter 2. The current conditions affecting the RCW and environmental effects are described in Chapter 3.

Alternative A would:

(1) Revise the Regional Wildlife Habitat Management Handbook, FSH 2609.23R (Handbook) and amend the Southern Regional Guide to incorporate the revised Handbook immediately after the Record of Decision. The revised Handbook would make Interim S&Gs the Regional direction for managing the red-cockaded woodpecker and its habitat. The revised Handbook would:

- o Designate as RCW habitat management zones the 3/4-mile radius circles (3/4-mile zones) around all active and inactive RCW clusters (colony sites). Approximately 1.4 million acres would be included within the 3/4-mile radius circles.

- o Establish population objectives based on existing 3/4-mile zones.

Table S-2. Comparison of Alternatives by Specific Management Activities

Specific Activities	Alternative A (No Action)	Alternative B	Alternative C	Alternative D	Alternative E (Proposed Action)
Habitat Management Area (HMA) Designated	No, management areas are 3/4-mile radius circles around active and inactive clusters	No, only clusters, replacement and recruitment stands are managed specifically for RCW.	Yes, habitat management areas are contiguous blocks of habitat with a 6,150-ac. minimum size. See Table S-1.	Same as Alternative C	Same as Alternative C
Setting Population Objectives	Yes, will comply with population objectives in 1985 Handbook	Yes, similar to Alternative A, but modified to comply with FWS RCW Recovery Plan.	Yes, based on existing RCW distribution . A min. of 250 breeding pair in recovery populations and minimum of 25 breeding pairs in support populations	Same as Alternative C	Same as Alternative C
Management Intensity Levels (MIL) Designated	No, however, the 3/4-mile radius circles are broken down into two zones which receive different levels of management	No	Yes, 5 MIL are identified	Same as Alternative C	Yes, 4 MIL are identified
Cavity Restrictors/artificial cavities	Required , objective is 4 usable cavities per cluster	Same as Alternative A	Same as Alternative A in MIL 5-2, optional in MIL 1	Same as Alternative C	Same as Alternative A in MIL 4-2, optional in MIL 1
Translocation	Required as needed	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
Prescribed Burning	Yes, entire 3/4-mile circle on 2-5 year cycle, growing season burns encouraged.	Emphasized only in clusters, replacement and recruitment stands. Not required in foraging habitat.	Same as Alternative A, except entire HMA.	Same as Alternative A	Similar to Alternative A, but recognizes need to burn any season as needed
Pine Restoration	Encouraged with restrictions to prevent habitat fragmentation, longleaf pine only.	Similar to Alternative A, but restoration of other pine species allowed.	Similar to Alternative B, with restrictions to prevent habitat fragmentation.	Same as Alternative C	Similar to Alternative C, area control by forest management type allowed
Foraging Habitat	≥ 8,490 square feet pine basal area. ≥ 6350 pine stems. ≥ 10" DBH & > 30 years old.	Same as Alternative A	Same as Alternative A, plus provision to provide foraging for non-FS RCW	Same as Alternative C	Same as Alternative C, except minimum age of foraging trees reduced to 25 years
Future Nesting Habitat Mgmt. Outside Clusters, Replacement and Recruitment Stands.	Yes, utilizing thinning to enhance development and no regeneration cutting in the oldest 1/3 of pine acres until within 10-20 years of rotation age through the first rotation.	Not required outside clusters	Same as Alternative A	Same as Alternative A	Same as Alternative A

Table S-2. Comparison of Alternatives by Specific Management Activities

Specific Activities	Alternative A (NoAction)	Alternative B	Alternative C	Alternative D	Alternative E (Proposed Action)
Rotation	120-year rotation on all pine species used by RCW is implied.	80 years longleaf and 70 years for other yellow pines with recruitment and replacement stands. Without R/R stands, 100 and 80 years.	Varies by site quality. Longleaf and shortleaf: 100-200 yrs. Loblolly and slash: 80-120 years. Virginia pine: 60-80 years.	No rotation or planned regeneration	Virginia pine: 70 years. Loblolly & slash pine: 100 years; Longleaf & shortleaf: 120 years; Loblolly and Shortleaf in high SPB risk areas: 80 years
Thinning	Encouraged, if foraging is available. Leave tree priorities: 1. relict tree 2. potential cavity trees 3. trees $\geq$ 10" DBH 4. trees $\leq$ 10" DBH	Similar to Alternative A, standard silviculture guidelines used to select leave trees	Same as Alternative A	Yes, on limited basis	Same as Alternative A, with exceptions to allow thinning if foraging is limited in overly dense mature pine stands.
Regeneration					
Clearcut*	To be considered only for pine restorations, to regenerate wet slash pine sites, and damaged or sparse stands	Clearcutting of suitable habitat may occur if site-specific analysis determines adequate foraging is maintained and not isolated from cluster	Same as Alternative A, plus regeneration of Virginia and pitch pine	Only used to restore desirable pine species	Similar to Alternative C, but wet site slash pine regeneration is not allowed
Standard Shelterwood/Seed-tree	Not allowed	Allowed	Allowed only in MIL 1 and MIL 2	Not allowed, no planned regeneration	Allowed in MIL 1
Irregular Shelterwood	Allowed between 1/4 & 3/4 mile of clusters	Allowed	Allowed, mitigation varies by MIL	Not allowed, no planned regeneration	Similar to Alternative C, but different mitigation
Group Selection Methods	Not allowed	Allowed per Forest Plans	Allowed	Not allowed, no planned timber harvest	Allowed
Single Tree Selection	Not allowed	Allowed per Forest Plans	Allowed	Not allowed, no planned timber harvest	Allowed
Monitoring	Mandatory	Mandatory	Mandatory, intensity varies by MIL	Same as Alternative C	Mandatory, intensity varies by population size and trend (not MIL)

* The use of clearcutting has been limited in all alternatives to conform with the Chief's 1330-1 letter dated June 4, 1992 and with the NFMA at 16 U.S.C. 1604 (g) (3) (F) (i). In keeping with this direction the amount of clearcutting will not vary significantly among the alternatives.

- o Establish three different management intensity zones, a high-intensity zone surrounding the cluster for 1/4 mile and a moderate-intensity zone forming a donut between 1/4 and 3/4 mile from each cluster. The area outside the 3/4-mile zone would be managed according to Forest Plans as amended.

- o Utilize irregular shelterwood (two-aged) as the primary regeneration method, with even-aged methods allowed in specific situations.

- o Limit regeneration of the oldest 1/3 of pine and pine-hardwood acres until they are within 10-20 years of rotation age. This will ensure suitable potential cavity trees in the shortest time.

- o Implement a 120-year rotation for all pine species used by RCW within the 3/4-mile zones by allowing no more than 8.5 percent and 25 percent in the 0-10 and 0-30 age classes respectively.

- o Emphasize thinning to reduce southern pine beetle risk and enhance RCW habitat.

- o Emphasize prescribed fire, including growing season burns, to control midstory vegetation in the pine and pine-hardwood forest types throughout HMAs, especially within clusters.

- o Assure adequate foraging habitat (6350 pine trees greater than 10" diameter, 30 years old or older within 1/2 mile of and connected to the clusters).

- o Encourage restoration of longleaf pine in areas where it occurred historically and would provide better habitat for the RCW.

- o Establish monitoring requirements to determine if the objectives of the new RCW management direction are being met.

- o Link monitoring intensity to the size and vulnerability of the RCW population.

ALTERNATIVE B

This alternative is based on the 1985 Handbook with modifications to incorporate management decisions made since 1985, such as the Vegetative Management ROD's, the Southern Pine Beetle ROD and the Fish and Wildlife Service Blue Book. New RCW management activities such as translocation, artificial cavities, and cavity restrictors have also been incorporated. The alternative is described in detail in Chapter 2. The current conditions affecting the RCW and environmental effects are described in Chapter 3.

Alternative B would:

(1) Revise the Regional Wildlife Habitat Management Handbook, FSH 2609.23R (Handbook) and amend the Southern Regional Guide to incorporate the revised Handbook immediately after the Record of Decision (ROD). The Revised Handbook would incorporate management decisions made since 1985, as well as new RCW management activities. The revised Handbook would:

- o Implement intensive RCW management within clusters, replacement, and recruitment stands and determine population objectives for recovery populations. Approximately 125,000 acres would be included within clusters, replacement and recruitment stands.

- o Establish sufficient recruitment stands to provide clusters to meet population objectives.

- o Permit the use of a wide range of regeneration methods outside the clusters, recruitment, and replacement stands, with management objectives taking precedence within the confines of multiple-use.

- o Continue to implement rotations governed by the Forest Plans outside cluster, recruitment, and replacement stands.

- o Emphasize thinning to reduce southern pine beetle risk and enhance RCW foraging habitat.

- o Emphasize prescribed fire to control midstory vegetation in the pine and pine-hardwood forest types within clusters, recruitment, and replacement stands.

- o Establish criteria to assure adequate foraging habitat (6350 pine trees greater than 10" diameter, 30 years old or older within 1/2 mile of and connected to the clusters).

- o Allow restoration of longleaf and other desirable pine species in areas where they occurred historically and would provide better habitat for the RCW.

- o Establish monitoring requirements to determine if the objectives of the new RCW management direction are being met.

(2) The Forest Service would continue to manage the National Forests where the RCW lives under current direction until the Forest Plans are revised or amended.

(3) Establish an implementation time line for the National Forests to amend or revise their Forest Plans to incorporate the specific elements of the Revised Handbook.

ALTERNATIVE C

Alternative C is based on the establishment of Habitat Management Areas with potential for extremely long rotations (up to 200 years). This alternative would set into motion an immediate and deferred set of actions, each containing various elements. These actions are described in detail in Chapter 2. The current conditions affecting the RCW and environmental effects are described in Chapter 3.

Alternative C would:

(1) Revise the Regional Wildlife Habitat Management Handbook, FSH 2609.23R and amend the Southern Regional Guide to incorporate the revised Handbook and revised Regional Guide through the Record of Decision (ROD). The revised Handbook would provide new Regional direction for managing red-cockaded woodpecker and its habitat.

This direction would not be implemented until the National Forests with RCW populations have individually amended or revised their Forest Plans. This would occur within one to three years after the signing of the ROD. The revised Handbook would:

- Establish criteria to delineate RCW Habitat Management Areas and determine population objectives to ensure demographic stability. Approximately two million acres would be included within HMAs.

- Establish five Management Intensity Levels based on the risk of extirpation faced by the RCW population in the HMA. The risk categories are determined by each population's size and trend. The smaller and more dispersed RCW populations are at greater risk and would be managed and monitored more intensively.

- Establish minimum rotation ages between 70 and 200 years depending on pine species and site quality. HMAs would produce woodpecker habitat and timber products on a sustained-yield basis.

- Emphasize thinning to reduce southern pine beetle risk and enhance RCW habitat.

- Emphasize prescribed fire, including growing season burns, to control midstory vegetation in the pine and pine-hardwood forest types throughout HMAs, especially within clusters.

- Encourage adequate foraging habitat (6350 pine trees greater than 10" diameter, 30 years old or older within 1/2 mile of and connected to the clusters).

- Permit a wide range of regeneration methods, with increased use of irregular shelterwood. The use of various silvicultural practices would be based on balancing current habitat needs and regeneration of the forest which will provide future habitat, existing stand condition, and site quality.

- Limit regeneration of the oldest 1/3 of pine and pine-hardwood acres until they are within 10-20 years of rotation age. This will ensure suitable potential cavity trees in the shortest time.

- Encourage restoration of longleaf and other desirable pine species in areas where they occurred historically and would benefit the RCW.

- Establish monitoring requirements to determine if the objectives of the new RCW management direction are being met.

- Require monitoring intensity be linked to Management Intensity Level which reflects the size and vulnerability of the RCW population.

(2) Immediately amend the 11 affected Forest Plans through the Record of Decision. The affected National Forests where RCW occur are: Alabama, Chattahoochee-Oconee, Cherokee, Daniel Boone, Croatan and Uwharrie, Florida, Francis Marion, Kisatchie, Mississippi, Ouachita, and Texas. These amendments would identify and delineate tentative RCW Habitat Management Areas (HMA) totaling approximately two million acres on the 11 National Forests. The ROD would also establish an implementation time line for the National Forests to amend or revise their Forest Plans to incorporate the specific elements of the revised Handbook.

Tentative HMAs would include suitable RCW habitat between the 3/4-mile radius circles around active and inactive clusters currently protected by Interim S&Gs. Interim S&Gs will remain in effect within the 3/4-mile radius circles until individual forest plans are amended/revised to incorporate the revised Handbook.

Within the tentative HMAs, but outside the 3/4-mile radius circles, Forest Plan standards and guidelines will remain in effect, except that only thinning, irregular shelterwood (two-aged), single-tree and group selection (uneven-aged) methods would be allowed. Clearcutting (even-aged) method could be used to restore longleaf or other desirable pine species on sites currently occupied by another species of pine. Sufficient recruitment stands and foraging habitat must be identified to meet tentative population objectives identified in Table 2-C1, before clearcutting can take place.

The primary regeneration methods proposed (two-aged and uneven-aged) retain relatively high basal area and canopy cover, which will preserve future management options until the time when the revised Handbook can be fully implemented through Forest Plan amendments or revisions.

ALTERNATIVE D

Alternative D is based on the establishment of Habitat Management Areas. It has no established rotation lengths and has no provisions for sustained production of forest products and benefits. The alternative was developed in response to the issue concerning the effect of commercial timber harvest on the RCW. This alternative would set into motion an immediate and deferred set of actions, each containing various elements. These are described in full detail in Chapter 2. The current conditions affecting the RCW and environmental effects are described in Chapter 3.

Alternative D would:

(1) Revise the Regional Wildlife Habitat Management Handbook, FSH 2609.23R (Handbook) and amend the Southern Regional Guide to incorporate the revised Handbook through the Record of Decision (ROD). The revised Handbook would provide new Regional direction for managing the red-cockaded woodpecker and its habitat. This direction would not be implemented until the National Forests with RCW populations have individually amended or revised their Forest Plans. This would occur within one to three years after the signing of the ROD. The revised Handbook would:

- Establish criteria to delineate RCW Habitat Management Areas (HMAs) and determine population objectives to ensure demographic stability. Approximately two million acres would be included within HMAs.

- Establish five Management Intensity Levels (MILs), which are based on the risk of extirpation (local extinction) faced by the RCW population in the HMA. The risk categories are determined by population size and trend.

- Eliminate sustained-yield forest management. A sustained flow of RCW habitat through time cannot be assured. Future regeneration of the forest would be dependent on natural seeding in openings created by dead and fallen trees.

- Emphasize thinning to reduce southern pine beetle risk and enhance RCW habitat.

- Emphasize prescribed fire, including growing season burns, to control midstory vegetation in the pine and pine-hardwood forest types throughout HMAs, especially within clusters.
- Encourage adequate foraging habitat (6350 pine trees greater than 10" diameter, 30 years old or older within 1/2 mile of and connected to the clusters).
- Encourage restoration of desirable pine species, such as longleaf pine in areas where they occurred historically and would provide better RCW habitat.
- Establish monitoring requirements to determine if the objectives of the new RCW management direction are being met.
- Required monitoring intensity be linked to Management Intensity Level (MIL), which reflects the size and vulnerability of the RCW population.

(2) Immediately amend 11 Forest Plans through the Record of Decision (ROD). The affected National Forests where RCW occur are: Alabama, Chattahoochee-Oconee, Cherokee, Daniel Boone, Croatan and Uwharrie, Florida, Francis Marion, Kisatchie, Mississippi, Ouachita, and Texas. These amendments would identify and delineate tentative RCW Habitat Management Areas (HMAs) totaling approximately two million acres on the 11 National Forests. The ROD would also establish an implementation time line for the National Forests to amend or revise their Forest Plans to incorporate the specific elements of the Regional direction.

Tentative HMAs would include suitable RCW habitat between the 3/4-mile radius circles around active and inactive clusters currently protected by Interim S&Gs. Interim S&Gs will remain in effect within the 3/4-mile radius circles until individual forest plans are amended/revised to incorporate the new RCW Regional direction, one to three years.

Within the tentative HMAs, but outside the 3/4-mile radius circles, Forest Plan standards and guidelines for the general forest area will remain in effect, except that only thinning, irregular shelterwood (two-aged), single-tree and group selection (uneven-aged) methods would be allowed. Clearcutting (even-aged) method could be used to restore longleaf or other desirable pine species on sites currently occupied by another species of pine. Sufficient recruitment stands and foraging habitat must be identified to meet tentative population objectives identified in Table 2-D1, before clearcutting can take place.

The primary regeneration methods proposed (two-aged and uneven-aged) retain relatively high basal area and canopy cover, which will preserve future management options until the time when the new RCW Regional direction can be fully implemented through Forest Plan amendments or revisions.

ALTERNATIVE E (THE PROPOSED ACTION)

Alternative E has been previously described under Proposed Action.

Environmental Consequences

Following is a summary of the environmental effects of the proposed action and the alternatives. Due to the programmatic nature of this environmental impact statement, the effects are presented in rather general terms. Effects will be assessed on a more site-specific basis as a part of the individual forest plan amendments/revisions.

The degree to which the **red-cockaded woodpecker** has been affected by past Forest Service management, especially even-aged silviculture, has been identified as an issue. Chapter 3 points out that adverse effects to RCW, in small populations of widely dispersed groups, resulting from even-aged silviculture has been documented. Conversely, the same study indicated that large populations with groups more closely spaced were not adversely affected by even larger amounts of even-aged regeneration of forest stands.

The lack of adverse effects in larger populations is borne out by RCW populations on the Francis Marion National Forest, the Vernon Ranger District of the Kisatchie National Forest and the Apalachicola Ranger District of the Apalachicola National Forest. These populations have sustained high RCW densities even though these Forest Service units have been intensively managed with even-aged regeneration methods (primarily clearcutting) for over 30 years.

The use of clearcutting has been limited in all alternatives to conform with the Chief's 1330-1 letter dated June 4, 1992 and with the NFMA at 16 U.S.C 1604 (g) (3) (F) (i). In keeping with this direction, the amount of clearcutting will not vary significantly among the alternatives.

The range of the RCW is occupied by a large number of other proposed, endangered, threatened, and sensitive (PETS) species. The effect of the proposed action and alternatives on PETS is an issue. The majority of PETS species found in habitats similar to that used by the RCW evolved along with the RCW. Alternatives A, C, D, and E, which apply proposed RCW management to relatively large blocks of land will in many cases improve the habitat for these other PETS, instead of having adverse effects. Alternative B, which applies intensive RCW management to a much smaller area, will benefit PETS less than the other alternatives.

Many wildlife species are dependent to some degree on the production and availability of mast (the fruit and nuts produced by a wide variety of primarily deciduous shrubs and trees). Prescribed burning and other methods will be used in all alternatives to intensively control/eliminate midstory in clusters, replacement and recruitment stands. Prescribed burning will be used throughout HMAs in Alternatives C, D, and E to reduce midstory vegetation (there will be no attempt to eliminate midstory within the HMA but outside the clusters, replacement or recruitment stands). These activities may reduce the number of mast producing shrubs and trees and could affect mast dependent species. The effect of prescribed burning and midstory control on mast producing species is based on acres treated. Alternatives A and B require midstory control on approximately 125,000 acres in clusters, replacement, and recruitment stands. Alternative A encourages midstory reduction on an additional 1,390,000 acres in the HMA.

Alternatives C and D require midstory control on approximately 160,000 acres and midstory reduction on an additional 1,840,000 acres. Alternative E treats acreage similar to Alternatives C and D, however, total midstory control is not required on the 160,000 acres.

Extension of rotation length for RCW habitat management, requirements to provide adequate foraging habitat, and prescribed regeneration methods specified in the proposed action and some of the other alternatives will bring about changes in available timber volumes. Potential timber volumes which may be available by alternative and 10-year period for the next 30 years are displayed in Table S-3.

The effect of each alternative on timber sale volume can only be estimated. The estimates provided here and in the EIS (at page 331 and Appendix F) represent neither minimum levels that must be met nor maximum levels that cannot be exceeded. They are rough approximations because of the difficulty associated with predicting actual timber sale levels over time. The complex nature of many of the standards and guidelines, agency land managers' discretion in administering forest plans and deciding when and where to offer timber sales, budgets, and other factors not apparent at this time, will all affect the timber volume that will actually be produced. The estimates represent our best assessment of the average amount of timber likely to be awarded in upcoming decades. Therefore, best use of the timber volume figures is for comparison purposes between alternatives.

Table S-3
Estimated Harvest Levels by Alternative and Time Period.
(Millions of Board Feet per Fiscal Year)
In most alternatives available volumes increase with time.

Time Period	Baseline* Volume	Alternatives A	B	C	D	E
Year 1-10						
Sawtimber	503	376(-25)**	401(-20)	334(-34)	395(-21)	396(-21)
Pulpwood	402	336(-16)	345(-14)	336(-16)	344(-14)	344(-14)
	905	712(-21)	746(-18)	670(-26)	740(-18)	740(-18)
Year 11-20						
Sawtimber	503	380(-24)	423(-16)	360(-28)	415(-17)	415(-17)
Pulpwood	402	341(-15)	352(-12)	350(-13)	352(-12)	352(-12)
	905	721(-20)	775(-14)	710(-22)	767(-15)	767(-15)
Year 21-30						
Sawtimber	503	417(-17)	489(-3)	384(-24)	330(-34)	409(-19)
Pulpwood	402	330(-18)	380(-5)	362(-10)	277(-31)	355(-12)
	905	747(-17)	869(-4)	746(-18)	607(-33)	764(-16)

* Baseline volumes are based on the average volume of pine sawtimber and pulpwood harvested from the 11 affected National Forests 1987-89, prior to implementation of Interim S&Gs. The 905 MMBF baseline is a reduction from the baseline used in the DEIS for the following reasons:

1. The current baseline takes into account the devastating effects of Hurricane Hugo on the Francis Marion National Forest. The baseline in the DEIS included 100 MMBF coming from the Francis Marion. Not making an adjustment to the baseline volume to take into account unavailability due to storm damage would attribute the volume reduction under the alternatives to RCW management, not the effect of the hurricane. Eighteen MMBF were included in the current baseline coming from the Francis Marion. This is the volume the Forest estimated could be harvested annually for the first decade under Alternative B, the guidelines that would have been in effect during the baseline period.

2. Current baseline volumes were also adjusted to account from hardwood volumes that were erroneously included in the DEIS baseline. Hardwood volumes will not be affected by RCW management and should not be included in baseline volumes.

The adjustments made for hurricane damage and inclusion of hardwood volumes were made across all alternatives for all time periods as well.

** The number in parenthesis is the percentage change from the baseline volumes.

The estimated **employment** associated with the harvest of timber from the 11 National Forests with RCW is shown in Table S-4. As with the available volume projections, employment is displayed by alternative and time period.

Table S-4
Estimated Employment Levels Generated by National Forest Timber Harvest.
(Jobs per Fiscal Year)
Employment levels increase over time in all alternatives except D.

Time Period	Baseline* Empl.	Alternatives A	B	C	D	E
Year 1-10	8,600	6,600	7,000	6,300	5,700	6,900
Year 11-20	8,600	6,800	7,300	6,500	6,000	7,100
Year 21-30	8,600	7,100	8,100	7,100	5,700	7,200

* Baseline employment is based on the average employment generated by harvest of National Forest timber in 1988-89, prior to implementation of Interim S&Gs.

The estimated income generated by the harvest of National Forest timber on the 11 National Forests with RCW is displayed in Table S-5. It is shown by alternative and time period.

Table S-5
Estimated Income Levels Generated by National Forest Timber Harvest.
(Millions of Dollars per Fiscal Year)
Income levels increase over time in all alternatives except D.

Time Period	Baseline* Income	Alternatives A	B	C	D	E
Year 1-10	217	171	179	161	145	178
Year 11-20	217	173	186	170	152	185
Year 21-30	217	179	209	179	146	183

* Baseline income is based on the average income generated by harvest of National Forest timber in 1988-89, prior to implementation of Interim S&G's.

Changes in employment and income are based on the estimated volumes from Table S-3.

Projected payments to the states are based on the average price received per MBF of sawtimber and pulpwood during the period October 1, 1993 - June 30, 1994. During this period the average revenue received per MBF of sawtimber and pulpwood was $148.88. Average revenue generated per MBF during the 1987-89 base line period was $49.26.

Even though available volumes decreased from 18 percent to 33 percent due to implementing the various alternatives, the increase in timber values more than offset the reduced volumes. Thus, the effects of any alternative will also be dependent on the variation in timber prices and mix of forest products produced.

The estimated dollars available for distribution to the states and counties are displayed in Table S-6. These estimates are based on the potential volumes of pine sawtimber and pulpwood from Table S-3. These values are only approximations to show the differences between the alternatives. Actual dollar amounts available could vary significantly. Because of the tremendous difference in value between sawtimber and pulpwood, the $148.88 average per MBF was not used to calculate the values in Table S-6. The regional pine sawtimber average value of $264.81 per MBF was used for sawtimber volume, $32.94 per MBF was used for pulpwood volume. Baseline values were calculated using the 1994 stumpage rates stated above, so comparisons could be made.

Table S-6
Estimated Payments to States Generated by National Forest Timber Harvest. (Millions of Dollars per Fiscal Year)
Payments to states have increased even though available timber volumes have decreased.

Time Period	Baseline* Payments	A	B	Alternatives C	D	E
Year 1-10	37	28	29	25	23	29
Year 11-20	37	28	31	27	24	30
Year 21-30	37	30	36	28	24	30

* Baseline payments to states is based on the average payments generated by harvest of National Forest timber in 1988-89, prior to implementation of Interim S&Gs. Baseline rates are presented in 1994 values.

This analysis discloses the effects of the alternatives at the Regional level, covering all National Forests with RCW. It is recognized some individual Forest Service units will experience greater reductions in economic outputs.

Most National Forests with RCW have traditionally received more money for the timber they sell than it cost to mark the timber and prepare the sale. Only one National Forest, the Daniel Boone in Kentucky, has not made enough money from its timber sales to meet expenses **(below cost)**. As a result of implementing any of the various alternatives, forests could be placed in a below-cost situation. The more extreme economic effects will occur on those forests where present conditions greatly restrict the future options under any alternative.

The National Forests in Florida is representative of this situation. This is due to the current method of calculating foraging habitat (providing 6350 pine stems 10 inches or greater in diameter, versus 125 acres of pine forest meeting specific criteria) and past management practices which allowed thinning all foraging habitat (pine trees greater than 10 inches diameter) to a basal area of 60 square feet. These stand conditions essentially prohibit harvest of sawtimber size trees for the next 20 years. The degree of impact will decrease with time as the stands currently in the 0-30 age classes grow older. This will again allow the harvest of sawtimber from the RCW HMAs, which will in turn increase revenues to a point greater than the cost of preparing sales (above cost).

Oil and natural gas are the predominate leasable minerals on the 11 National Forests with RCW. Of these 11 forests, five have significant acreage under lease for oil and gas. Restrictions on activities within RCW clusters could limit access for exploration and development. The acres on which surface occupancy is prohibited and acres where occupancy may occur in RCW HMAs is presented in Table S-7. Prohibitions on surface occupancy does not preclude use of diagonal drilling or other techniques to develop leasable minerals.

Table S-7
Area In Tentative RCW HMAs Where Oil and Gas Exploration is Affected, by Alternative.
The area where activities are restricted represent a small percentage of all National Forest acres.

Limitation	Area Affected (thousand acres) Alternatives A	B	C	D	E
Surface Occupancy Prohibited	124.5	124.5	156.7	156.7	156.7
Allowed*	1390.0	**	1861.4	1861.4	1861.4

* Depending on proximity to active clusters, restrictions on timing of drilling activity to avoid nesting season may be required.
** Alternative B has no HMA other than clusters.

Outdoor **recreation** is a significant use of the National Forests. Implementation of the proposed action or alternatives may affect the construction or use of recreation facilities, including off-road vehicle trails.

Alternative B would allow the construction of an off-road vehicle trail through a cluster if the construction activities take place outside the nesting season and cavity trees are protected. Facilities with heavy concentrated human use, such as camp grounds, would be located outside clusters if possible.

Alternatives A, C, D, and E prohibit the construction of such facilities or trails within clusters. However, if a RCW should excavate a cavity and move near an existing facility or trail, the facility or trail would not be affected unless monitoring indicates an adverse effect on the RCW due to the facility's presence and use. Such adverse effects are not likely. It may take several months, even years, for a RCW to excavate a cavity, and during this extended time, use of the facility/trail will surely have occurred.

The control of southern pine beetles to protect RCW clusters or foraging habitat within **wilderness** involves the cutting of trees. Depending on the severity of the beetle outbreak, few or many acres of trees may be cut. Such cutting would change the appearance of the wilderness, affecting the quality of wilderness experience enjoyed by some visitors.

All alternatives recommend that RCW within wilderness be managed in accordance with appropriate guidelines (see FSM 2323.31b for direction on manipulation of wildlife habitat within wilderness). In addition, Alternatives A, C, D, and E recommend that RCW within wildernesses be drawn out of the area through development of recruitment stands with artificial cavities. This would allow more freedom in the future management of these RCW and result in no effects on the current appearance of the wilderness.

Alternatives A, B, C, and D would continue to allow southern pine beetle control per the Southern Pine Beetle Environmental Impact Statement and Record of Decision to protect RCW clusters and foraging habitat within designated wilderness.

Alternative E would not control southern pine beetle to protect RCW groups within wilderness, but may take control actions within a wilderness to protect an essential group located outside the wilderness boundary.

The only activity to accomplish RCW management objectives which could degrade **air quality** is the prescribed burning needed to keep midstory under control. The potential effect on air quality is proportional to the acres being burned each year and the time of year the burning occurs.

Alternative A proposes the burning of approximately 363,000 acres annually. Emphasis is on growing season burns.

Alternative B requires the fewest acres be prescribed burned annually, approximately 32,000. Emphasis is on dormant season burns.

Alternative C and D calls for prescribed burning of approximately 490,000 acres annually, emphasis is on growing season burns

Alternative E burns the same acres as does Alternative C and D. Growing season burning is emphasized; however, burning is likely to occur any time during the year when conditions are appropriate.

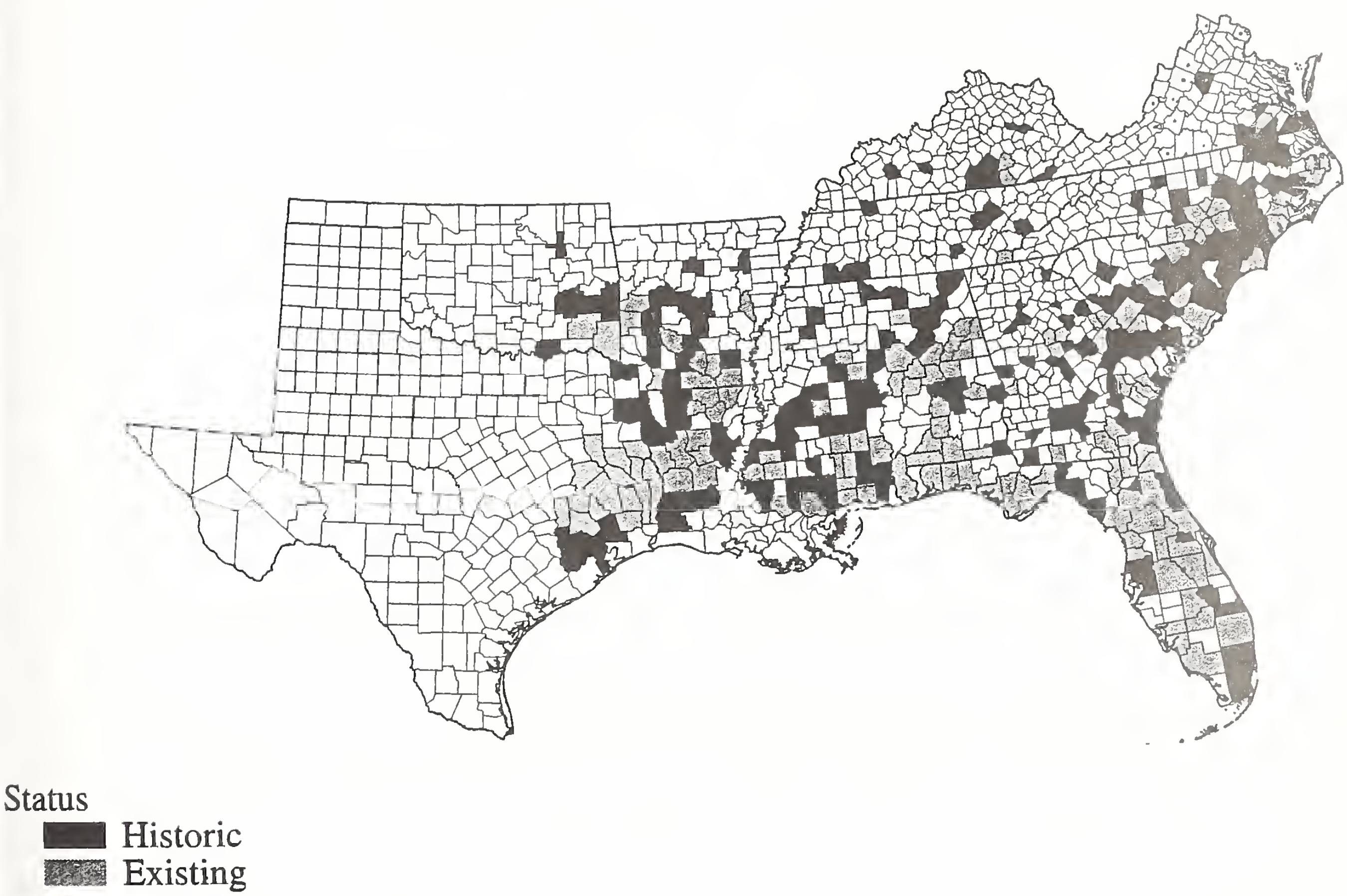
INTRODUCTION

Red-Cockaded Woodpecker - Biology and Range

The red-cockaded woodpecker (RCW) is slightly larger than a bluebird, about seven inches long. In the field it appears black and white with a large white cheek patch. The sexes are almost identical except the male has a small tuft of red feathers, the cockade, located above the eye at the top of the cheek patch. The cockade is inconspicuous and is rarely seen in the field (Hooper et al. 1980).

The red-cockaded woodpecker is a nonmigratory species that once commanded a wide range throughout the pine belt of the southern United States. Figure I-1 shows the historic range of the red-cockaded woodpecker extending from Missouri, Kentucky, and Maryland, southward to Florida, and westward to eastern Texas.

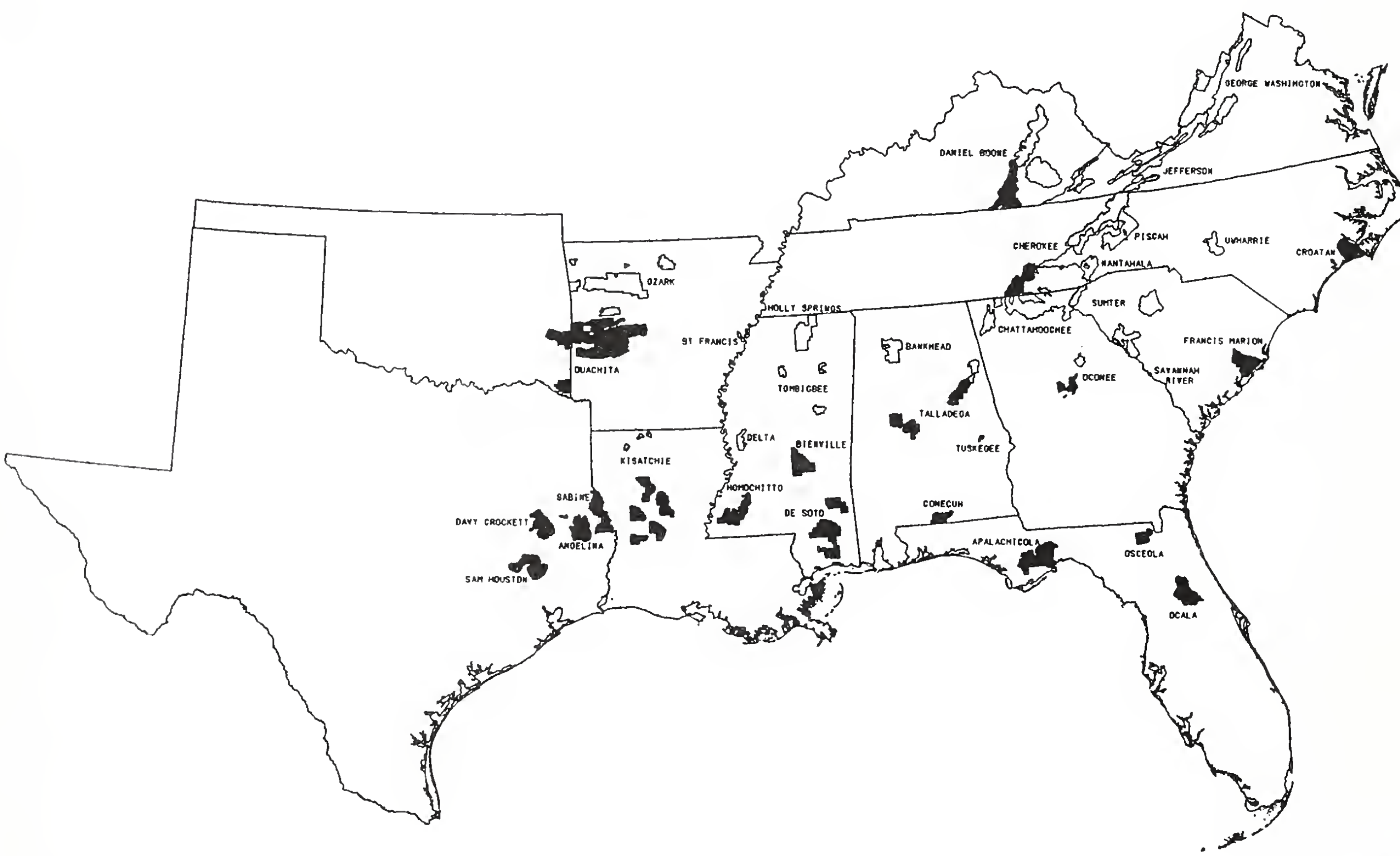
Figure I-1
Historical Range of the Red-Cockaded Woodpecker
The pine and pine-hardwood forests covered much of the southeastern U.S. and were maintained by frequent low-intensity fires.



The RCW was first listed as an endangered species in 1970. The primary reason for the RCW's decline in numbers can be presumed from historical accounts of the settling of the South and subsequent clearing of the Southern forest. The red-cockaded woodpecker is most frequently associated with the longleaf pine forest type, but is also found in loblolly, slash, shortleaf, pond, and Virginia pine. By the 1930's most of the South's pine forest had been cut over. Undoubtedly, RCW populations declined dramatically as the pine forest disappeared.

The current range of the RCW is limited and fragmented. The largest remaining RCW populations exist on the National Forests extending along the Coastal Plain from North Carolina to Texas, the Piedmont of Georgia and Alabama, and into the interior highlands of Arkansas, Oklahoma, Tennessee, and Kentucky. Figure I-2 shows the location of National Forests of the Southern Region which currently have RCW populations.

Figure I-2
Current Range of the Red-Cockaded Woodpecker on National Forest Lands
The remaining RCWs live primarily within the National Forests shaded.



The RCW is unique in that it is the only woodpecker which exclusively uses living pine trees in which to excavate its cavities (USDI 1985). They also tend to select trees infected with a heartwood decaying fungus Phellinus pini (Conner and Locke 1982). Heartrot is not commonly found in longleaf pine until around 100 years of age and not in loblolly until about 75 years (Wahlenberg 1946, 1960). Therefore, most RCW cavities are found in older, mature pines. The RCW prefers open, park-like pine stands with very little midstory vegetation.

The RCW has an advanced social system that revolves around family groups (clans), which usually include one pair of breeding birds, the current year's offspring and several male adults called helpers. A group may have from two to nine birds but never more than one breeding pair. Young males from the previous years may become helpers, assisting the breeding pair by incubating eggs and feeding the young. Young females disperse after several months, apparently in search of a mate.

A group uses between one and 10 cavity trees, termed a cluster (colony site), for nesting and roosting. The cavities in these pines may be complete or unfinished, active or inactive. Active clusters contain cavity trees used by the RCW. Inactive clusters are considered abandoned when not used for more three years or made unusable by competitors. The birds may naturally abandon a cavity, or other cavity-dwelling animals may force them out. Mammals, particularly southern flying squirrel, other birds, and reptiles can move into the RCW's cavities (Loeb 1993). RCWs are primary cavity nesters; they are capable of excavating their own cavities. As such, they are considered a "keystone species," and the survival of other cavity nesters which cannot excavate their own cavities depends on the RCW.

The cavity trees are essential to the RCW because they provide shelter and a place to nest and raise the young. The RCW nests between March and July. The female usually lays two to four eggs in the breeding male's roosting cavity. Members of the group take turns incubating the eggs during the day while the breeding male sits on the eggs at night. The eggs hatch in 10-12 days. Nestlings are very vocal, especially during feeding time, and can be heard from the ground.

RCWs spend a great deal of time and energy scaling the trunks and limbs of living pine trees looking for food. They eat a variety of insects, insect eggs and larvae, including the southern pine beetle. They use their beak to chip off bark, then eat the insects that live under the bark. Each group establishes a foraging area and defends it against other red-cockaded woodpeckers. The foraging area depends on the quality of the habitat surrounding the cluster. They prefer relatively large pine trees and an open stand structure, but they also occasionally feed in areas with hardwoods.

Clusters and RCW Groups: Terminology

This document will refer to the area (minimum of 10 acres) surrounding aggregates of cavity trees as clusters, and RCW family units as groups.

The term colony or colony site has been used in much of the literature, including the red-cockaded woodpecker recovery plan and all existing National Forest System RCW management direction, to refer to one or more RCW cavity trees.

Walters et al. (1988b) suggested using the term cluster in place of colony to define the aggregate of cavity trees. They considered the term colony to be misleading because the colony already had a well established and fundamentally different definition in the ornithological (bird related) literature. The established definition for colony referred to the nesting location of truly colonial nesters such as snowy egret, royal tern, bank swallow, and cliff swallow. These species could have hundreds of nests concentrated in a small area.

We will refer to the RCW cavity trees as a cluster to avoid confusion or false images of numerous RCWs nesting in a small area. Cluster refers to an aggregate of cavity trees, describing both active and inactive.

Confusion has also existed when discussing the RCWs associated with individual clusters. Traditionally, these groups of RCWs have been referred to as clans, but more often than not, they were also referred to as colonies. Some examples include references to single male colonies, the colony consisted of a breeding pair and one helper, or the colony failed to fledge any young. To avoid any confusion, we will use the term group when referring to the RCWs associated with a cluster. A group can consist of one or more RCW.

Past RCW Management and Litigation

The following chronology briefly describes the many events associated with past management of the RCW on National Forest lands. It starts with the listing of the RCW as endangered in 1970 through the development of this environmental impact statement, the most recent of several efforts by the Forest Service to incorporate up-to-date information into its RCW management direction.

Listing as an Endangered Species

The RCW was first identified as a rare and endangered species in 1968 (USDI Fish and Wildlife Service 1968), and was officially listed as endangered in 1970 (35 FR 16047, Oct. 13, 1970). With passage of the Endangered Species Act (ESA) in 1973, the RCW received Federal endangered species protection. Listing the species as endangered generated significant interest in the RCW by the scientific community. This interest has continued and has resulted in a significant amount of research by both Forest Service and other researchers. Past RCW management, described below, reflects the evolution of our knowledge of the species. The current effort to improve RCW management on the National Forests is a continuation of that evolution.

1975 Wildlife Habitat Management Handbook

The Forest Service amended its Regional Wildlife Habitat Management Handbook, FSH 2609.23R (Handbook) by adding a chapter on RCW management in July 1975. This initial effort to manage the RCW protected the cavity trees and established a 200-foot buffer around each cavity tree. Hardwood midstory was to be controlled within the cluster (buffer area) and 40 acres of pine forest greater than 20 years old adjacent to the cluster was retained to provide foraging habitat. There was no formal or informal consultation with the Fish and Wildlife Service on this document.

1979 Handbook Revision and Recovery Plan

The Fish and Wildlife Service approved a RCW Recovery Plan in 1979, under the authority of the ESA (USDI Fish and Wildlife Service 1979). The RCW Recovery Plan recommends:

- Protection of cavity trees and a 200-foot buffer around them;
- Maintaining at least 200 acres of habitat, including the cluster;
- Identification and retention of recruitment stands;
- Midstory control; and
- Rotations of at least 100 years for longleaf pine and 80 years for other yellow pines.

The Forest Service then revised the RCW chapter of its Handbook in October 1979. This revision expanded the foraging area required in the 1975 Handbook to range between 100 to 250 acres and recommended rotations of at least 80 years for longleaf pine and 70 years for the other yellow pine species. The revised Handbook also called for identifying recruitment stands and midstory control. Again, there was no formal or informal consultation with the Fish and Wildlife Service on this document.

Pursuant to the NFMA implementing regulations at 36 CFR 219, the Forest Service issued the Regional Guide for the Southern Region in June 1984. It provides Regional standards and guidelines to the National Forests within the Southern Region. The Guide incorporated by reference the RCW Chapter of the 1979 Handbook as specific RCW management direction.

1985 Revision of Recovery Plan and Handbook

In 1985, the Fish and Wildlife Service revised its 1979 RCW Recovery Plan. As previously mentioned, listing of the RCW as endangered generated a significant amount of research on the species. The 1985 revision of the recovery plan incorporated the flush of research findings which became available after the original plan was completed. The Revised Recovery Plan identified 15 RCW recovery populations needed to conserve the species (USDI Fish and Wildlife Service 1985). Twelve of the recovery populations are totally or in part dependent on National Forest System land.

The Forest Service revised its Handbook guidelines in March 1985 to increase protection of the RCW. The revised Handbook identified RCW populations on National Forests, established population objectives and added three habitat protection standards:

(1) Replacement stands for all active clusters, to replace aging clusters with suitable trees for nesting habitat.

(2) Additional recruitment stands in areas which were below their population objectives.

(3) Changed foraging area to 125 acres of pine or pine-hardwood older than 30 years with at least 40% being older than 60 years or maintain at least 6350 pine stems greater than 10 inches diameter. The foraging must also be contiguous with the cluster and be entirely within 1/2 mile of it. The new foraging criteria was required for all active clusters and recruitment stands.

The Forest Service initiated formal consultation with the Fish and Wildlife Service on the 1985 Handbook revision. The Fish and Wildlife Service found that the proposed management would "not jeopardize the continued existence of the RCW."

RCW Management on the National Forests of Texas - Litigation and the Court-Ordered Plan

In 1988, the Sierra Club and the Texas Committee on Natural Resources amended an ongoing suit (originally captioned Sierra Club v. Block, now Sierra Club v. Glickman) against the National Forests in Texas to include allegations that the Forest Service's management practices "jeopardized" the RCW and constituted a "taking" of the RCW in violation of the Endangered Species Act (ESA) Sections 7 and 9 (16 USC 1536, 1538). The District Court found the Forest Service in violation of Sections 7 and 9 of the ESA and ordered the Forest Service to use modified uneven-aged timber management on areas of the forests within 1200 meters of RCW clusters. The order affected about 33% of the acreage on the National Forests in Texas.

In March 1991, the Fifth Circuit Court of Appeals affirmed the District Court as to the ESA violations, but vacated that part of the District Court's order that mandated specific management for the RCW. The Circuit Court ruled that the Forest Service was to propose a plan and consult with the Fish and Wildlife Service on it pursuant to the ESA. The District Court is then to review the plan and shall approve it unless the Court concludes the Forest Service was arbitrary and capricious in developing the plan. The Forest Service decided to adopt Interim Standards and Guidelines for the Protection and Management of the RCW Habitat Within 3/4 Mile of Colony Sites (Interim S&Gs), in place in the rest of the Region since May 1990. (See description of Phase 2 at page xxxviii.) Following consultation, and receipt of a "no jeopardy" opinion by the FWS, the Forest Service submitted the plan to the court in June, 1992. In March, 1994 the District Court rejected the Interim Standards and Guidelines as they pertain to the National Forests in Texas because they included even-aged forest management. The District Court's rejection has been appealed to the Fifth Circuit Court of Appeals. To date, there has been no ruling by the Fifth Circuit.

Costa - Escano Report

In 1988 the Forest Service surveyed the 11 National Forests in the Southern Region which have RCW populations. The survey indicated that 67 percent of the populations were declining (Costa and Escano 1989). Based on this evidence, in September 1988 the Forest Service requested initiation of formal consultation with the Fish and Wildlife Service on amending the Handbook. The Fish and Wildlife Service responded that informal consultation was appropriate for such an action.

Three-Phase Process to Develop New Regional Management Direction for RCW Recovery

The results of the Costa-Escano Report indicating declines in RCW populations on several National Forests, the legal precedent set by the litigation in Texas, and continuous improvement in our knowledge and understanding of the RCW led to the decision to develop new regional management direction for recovery of the species.

The Regional Forester decided upon a three-phase process. Phase 1 was an Immediate action to protect the small declining RCW populations. Phase 2 was a set of interim standards and guidelines developed and implemented to govern management of RCW and its habitat until longer term management direction is adopted. Phase 3 will be new regional direction for management of the RCW developed through preparation of this environmental impact statement and subsequent decision made through the record of decision.

Descriptions of the three phases follow, In the order of thelr implementation, as a part of this chronology.

Phase 1 - Policy on Cutting Within 3/4 Mile of RCW Colonies on Existing Timber Sale Contracts (March 27 Policy)

On March 27, 1989, to address the problem of unstable or declining RCW populations, the Southern Regional Forester established the March 27 Policy.

The March 27 Policy applied to all National Forests in the Region with RCW populations of 250 or fewer active clusters, with the exception of the National Forest in Texas which is managed pursuant to a court order. It applied to existing, advertised, and proposed sales of timber within 3/4 mile of active or inactive RCW clusters. The March 27 Policy modified most existing sales from clearcutting, shelterwood, or seed-tree harvest methods to thinning. Advertised sales not yet sold were changed to thinning, and any proposed sales to be advertised and sold during the life of the policy were also to be thinning only, with some exceptions. The policy supplemented direction in the Handbook to ensure management activities are not likely to jeopardize the continued existence of RCW.

The March 27 Policy was essentially a holding action, halting or modifying any ongoing project or projects at the proposed or advertised stage. In adopting the policy, the Regional Forester indicated that two additional phases would follow in an effort to establish effective long-term management of RCW habitat.

The affected Forest Plans were amended on June 26, 1989, to incorporate the March 27 Policy through nonsignificant amendments following completion of an Environmental Assessment and Decision Notice on the policy. The March 27 Policy remained in effect until Phase 2 was completed and implemented.

The Southern Timber Purchasers Council and three lumber companies sued the Forest Service and the Fish and Wildlife Service in December, alleging that the March 27 Policy violated the Endangered Species Act (ESA), the National Environmental Policy Act (NEPA), and the National Forest Management Act (NFMA).

The Federal District Court ruled that plaintiffs had no standing to bring suit under NEPA and ESA and upheld the Policy as to the NFMA claims.

In June 1993, the Eleventh Circuit Court of Appeals affirmed the District Court's ruling on standing as to NEPA and ESA and vacated the District Court's ruling as to NFMA, finding instead that plaintiffs have no standing to sue under NFMA.

Following adoption of the March 27 Policy, three events occurred which influenced the development of Phase 2: Hurricane Hugo devastated the RCW population on the Francis Marion National Forest, the Fish and Wildlife Service issued the "Blue Book," and the National Wildlife Federation sponsored the Scientific Summit on the RCW. The following is a discussion of the impact of these events.

Hurricane Hugo

In September 1989, Hurricane Hugo devastated the Francis Marion National Forest in South Carolina. The Francis Marion was the second largest RCW population in existence and was recognized as the most viable, having experienced a 10-percent population increase in the 10-year period prior to Hugo (Hooper et al. 1991b). The storm felled 87 percent of known cavity trees and possibly killed 63 percent of the RCW (Hooper et al. 1990). From a pre-hurricane population of 477 groups, the population fell to 238 groups, this at the end of the first breeding season after the storm and after approximately 500 artificial cavities were installed (Watson et al. 1995).

The Forest Service made tremendous efforts to stabilize the population by drilling or installing over 1,000 artificial cavities. Artificial cavities were a promising experiment at the time of the hurricane, but the devastation left by Hugo made it necessary to employ them on a wide scale. Both drilled and inserted cavities succeeded in providing emergency nesting and roosting habitat for the surviving RCW.

Drilled cavities were originally developed by Carole Copeyon at North Carolina State University (Copeyon 1990) and later modified by Forest Service personnel for large-scale use (Taylor and Hooper 1991). Artificial cavity inserts were developed by David Allen at the Southeastern Forest Experiment Station (Allen 1991). Both methods have been extremely successful in providing nesting and roosting sites for the surviving RCW population (Watson et al. 1995). See Chapter 2, pages 44-47 for a description of artificial cavities.

The RCW has proven to be more resilient to periodic but devastating events like hurricanes than previously thought. This natural resilience, combined with the concentrated efforts by the Forest Service and other agencies in South Carolina, quickly stabilized the population and reduced future losses.

The Forest Service experience in RCW recovery after Hugo demonstrates that the RCW can be recovered through aggressive and careful management. The experience and research findings are integrated into the proposed action.

The Fish and Wildlife Service "Blue Book"

The Fish and Wildlife Service issued "The Guidelines for the Preparation of Biological Assessments and Evaluations for the Red-Cockaded Woodpecker," now referred to as "The Blue Book," in September 1989.

As the title implies, it is a set of guidelines to be used by all Federal agencies with RCW on their lands when assessing the impact of various activities on the RCW.

The RCW Recovery Plan, as did the Handbook, offered RCW managers two options to determine availability of foraging habitat. One option, the one most frequently used, required the retention of 125 acres of pine or pine-hardwood forest meeting specific criteria with respect to tree age, size, and spatial arrangement. These acres must be connected to and entirely within 1/2 mile of the cluster. The 125 acres was the average area needed to provide the number of stems and basal area described below.

The second option was used infrequently and required the retention of at least 6350 pine trees 10 inches or greater in diameter and at least 8490 square feet of pine basal area. These stems and basal area must be available within 1/2 mile of and connected to the cluster.

The Fish and Wildlife Service found that in many instances the 125-acre option was not providing an adequate number of stems or basal area. They developed the Blue Book to change the emphasis on how foraging availability is determined. The Blue Book requires each RCW group to have 6350 pine stems 10 inches in diameter or larger and 8490 square feet of pine basal area, regardless of how many acres are needed to provide it.

The Forest Service has determined the availability of foraging using the stem/basal area option since the Blue Book was issued. This method of determining available foraging habitat was included in the Interim S&Gs and in all alternatives in this environmental impact statement.

Scientific Summit on the Red-cockaded Woodpecker

In March of 1990, the National Wildlife Federation sponsored a Scientific Summit on the Red-cockaded Woodpecker. Twenty-four biologists and resource managers, widely respected experts on the RCW, attended. Efforts were made to include participants representing the range of perspectives which exist among different organizations and federal and state agencies.

The intent of the Summit was to develop consensus, where possible, about the biological needs of the RCW and to make recommendations for managing its recovery. Numerous areas of consensus emerged and several management initiatives were recommended to enhance conditions for the RCW. Differences of opinion were sometimes resolved by establishing acceptable "ranges." Following is a brief summary of some key points of consensus:

- In the absence of site-specific reproductive data, 500 active clusters are needed to support long-term viability, allowing a population to be declared recovered.
- Clusters separated by 18 or fewer miles of continuously suitable habitat should be considered part of the same population.
- Older trees, 80-250+ years, are recommended to provide nesting habitat.
- Midstory control is critical in clusters and may be desirable in foraging habitat. Retention of some hardwood midstory is appropriate.
- Ecosystem management is desirable, with management practices mimicking natural systems.
- Growing season burns should be implemented where appropriate.
- Plantation forest management schemes should be replaced with other approaches. Suggested alternatives were seed-tree, shelterwood, and irregular shelterwood methods.
- Begin managing the RCW on an areawide basis rather concentrating on the clusters and contiguous foraging habitat.
- Develop an emergency action plan to stop the decline of small and vulnerable populations.

Some opposing viewpoints discussed included:

- Size of regeneration areas where even-aged management methods are implemented. Recommendations ranged from 10 to 80 acres.

- Although agreed that seed-tree, shelterwood, and irregular shelterwood methods provide some degree of continuous forest cover for use as foraging and future nesting habitat, use of clearcutting was staunchly supported for specific situations, such as restoration of longleaf pine.

The Summary Report of the Summit, compiled by the Southeastern Negotiation Network, Georgia Institute of Technology, can be found in Appendix G of this environmental impact statement.

Phase 2

Interim Standards and Guidelines for Protection and Management of RCW Habitat Within 3/4 Mile of Colony Sites (Interim S&Gs)

Phase 2 emphasizes continuing the March 27 Policy's protection of existing RCW clusters while allowing management options to enhance RCW habitat. The intent of Interim S&Gs was to halt population declines, stabilize the RCW populations, begin improving habitat, and increase populations where possible.

The Forest Service issued the Interim S&Gs in May 1990. Interim S&Gs supplemented the 1985 Handbook to protect all RCW groups on National Forests with populations of 250 or fewer RCW groups. Interim S&Gs limited silvicultural practices within 1/4- and 3/4-mile circles surrounding all active and inactive RCW clusters. It required that 25 to 40 square feet of pine basal area be retained after any regeneration cutting within the 1/4- to 3/4-mile zone. It allowed clearcutting only to reestablish longleaf pine to improve future RCW habitat.

Interim S&Gs originally applied to all RCW populations except the Apalachicola National Forest in Florida, the Kisatchie-Vernon-Evangeline population in Louisiana, and the National Forests in Texas. The Florida and Louisiana populations were excluded because each had greater than 250 active clusters (USDA 1990). The National Forests in Texas were excluded because the court-ordered management plan remained in effect. The Interim standards and guidelines were incorporated into affected Forest Plans as nonsignificant amendments.

Following informal consultation with the Fish and Wildlife Service and further consideration of the Kisatchie, Vernon, Evangeline, and Apalachicola populations, the Forest Service decided to place them under Interim S&Gs also, in May 1991. The Forest Service concluded that the RCWs on the three Louisiana districts were three distinct populations of less than 250 groups and that the health of the Apalachicola was sufficiently uncertain to merit extending the Interim S&Gs to these forests.

The Interim S&Gs are the current management direction on all National Forests in the Southern Region, except in the National Forest in Texas.

Phase 3

Regional Direction for RCW Management

Phase 3 is divided into two separate and distinct parts. The first part will be the decision pertaining to this environmental impact statement which will: (1) Decide what the new regional RCW management direction will be and revise the Handbook and amend the Regional Guide accordingly, and (2) provide Immediate protection for RCW habitat beyond the 3/4-mile radius circles already protected by the Interim S&Gs by amending 11 Forest Plans to identify tentative HMAs and tentative population objectives for each RCW population and allowing only thinning, two-aged (irregular shelterwood), and uneven-aged silviculture until the affected Forest Plans can be revised or further amended to incorporate the new management direction. Clearcutting can be used to restore longleaf or other pine species desirable to RCW on sites currently occupied by another species of pine. If a Forest chooses to begin restoration during the transition period between the signing of the ROD and their Forest Plan amendment or revision, the Forest must first identify sufficient recruitment stands and foraging habitat to meet their tentative population objective identified In Table 2-E1.

The second part of Phase 3 is the final step of implementing the new RCW management direction and involves the revision or amendment of the 11 Individual Forest Plans. The Regional Forester has choosen to use this two-step approach because it responds to the recovery needs of the RCW across its range. At the same time it allows individual forests the flexibility to integrate RCW management with the full range of other multiple uses, and the social and economic factors specific to a geographic area.

The RCW occupies a variety of habitats throughout its range. The RCW management direction established through this two-step approach will provide the consistency needed to aid recovery of the species, yet allow Forest Plan and project level decisions to be responsive to local habitat conditions and other considerations. Decisions such as the delineation of the final HMAs, allowable sale quantities, rotation lengths, and the mix of forest regeneration methods used to perpetuate RCW habitat are best made at these levels. The level of analysis necessary to adequately integrate the new RCW management direction with the variety of other multiple uses, and social and economic factors across the birds' range is certainly beyond the scope of this regional programmatic environmental Impact statement.

In this second step each affected forest will consider a range of options to implement the new RCW management direction, within the flexibility provided. This approach provides a logical system for the Forest Service to comply with its many governing laws and regulations, while better disclosing the effects of the proposed actions.

CHAPTER 1

PURPOSE AND NEED

PROPOSED ACTION

The Forest Service proposes to revise the Regional Wildlife Habitat Management Handbook, amend the Southern Regional Guide, and amend affected Forest Plans with new management direction for the endangered red-cockaded woodpecker. The proposed action has several elements and levels of implementation.

The revised Handbook/Regional Guide Amendment (Revised Handbook) would establish criteria to delineate RCW Habitat Management Areas (HMAs) and determine population objectives and establish standards and guidelines for management within HMAs. This direction would be implemented on each affected forest when Incorporated in the Forest Plan by amendment or revision.

Because of the time lag between the Handbook revision/Regional Guide amendment and the individual Forest Plan amendments or revisions, the Forest Service also proposes to amend the relevant Forest Plans to designate tentative HMAs in the Record of Decision (ROD) for this EIS. The Forest Plan amendments designating tentative HMAs would require specific management practices to conserve the RCW and avoid jeopardy to the species, and would remain in place until superseded by the individual Forest Plan amendments or revisions to incorporate the revised Handbook/Regional Guide direction.

The proposed Regional direction has two primary purposes: (1) Protect RCWs and their habitat so existing populations may be conserved and, (2) Improve habitat throughout identified HMAs to avoid jeopardy and to aid recovery of the species on National Forest System lands. We propose to manage RCW populations and habitat so that: (1) 12 recovery populations increase to or beyond 400 potential breeding pairs (if the land base allows) and, (2) 14 RCW support populations increase to or beyond 40 potential breeding pairs.

The Forest Service has formally adopted a policy of ecosystem management. Accordingly, National Forests and Grasslands will be managed based on ecological principals in such a way as to provide for the needs of people and to ensure the sustainability, productivity, and diversity of ecosystems. The proposed action must be consistent with this approach. We developed and evaluated alternative proposals that consider what is known of the biology and ecology of the RCW, and what is known about the structure and function of the ecosystems in which it evolved.

A variety of ecosystems are included within the tentative HMAs. For this regional analysis it was necessary to focus on those aspects of ecosystem structure, composition, and function that were similar in all the various ecosystems. Unifying ecosystem traits included: (1) the dominance or shared dominance of a pine species that is tolerant of fire (at least after it has attained some minimum size), (2) sparse to absent midstory, (3) a primarily herbaceous ground layer on many sites, and (4) the recurrence of fire as a disturbance process. Although these traits varied somewhat, they were considered to be generally applicable throughout the HMAs and were accepted as desirable conditions for suitable RCW habitat and subsequent recovery.

It is assumed that providing the above conditions, through a variety of management activities, will avoid jeopardy and help achieve the goal of RCW recovery by following ecological principles. Given the existing condition of these ecosystems, the disjunct ownership patterns of Forest Service System Lands, and human needs, it is doubtful if this, or any, management strategy will be capable of restoring the pre-Colombian conditions the RCW likely evolved with. Pre-Colombian conditions are not necessary to recover the RCW. However, the efforts outlined in the proposed action should yield ecological systems that are structured and function much more like the pre-Colombian systems the RCW evolved with than those systems in their current condition.

Elements of the Proposed Action

The proposed action contains two elements and various activities within each element. These activities are summarized below and presented in full detail in Chapter 2 (Alternatives Including the Proposed Action). The current condition of the environment and environmental effects of the proposed action and other alternatives are described in Chapter 3.

The Forest Service proposes to:

(1) Revise the Regional Wildlife Habitat Management Handbook, FSH 2609.23R, RCW Chapter (Handbook) to establish new Regional Direction for the management of the red-cockaded woodpecker and its habitat and amend the Southern Regional Guide to Incorporate the revised chapter. The Handbook would be revised and the Regional Guide amended through the ROD, but would not be implemented until the National Forests with RCW populations have individually amended or revised their Forest Plans. Within one to three years, depending on each National Forest amendment or revision schedule, the affected Forest Plans would be amended or revised to incorporate the Revised handbook/Regional Guide amendment. The Revised Handbook would:

- Establish criteria to delineate RCW HMAs.
- Determine population objectives that ensure demographic stability.
- Establish four Management Intensity Levels (MILs) which are based on the risk of extirpation (local extinction) faced by the RCW population in the HMA. The risk categories are determined based on population size and trend. This "variable assist" approach to RCW recovery increases the level of habitat protection and management for high-risk populations.
- Emphasize the use of artificial cavities and the moving of RCW from area to area (translocation) to speed population expansion and recovery of the species.
- Establish minimum rotation lengths ranging from 70 to 120 years depending on the species of pine being managed in stands managed with even-aged and two-aged regeneration methods. Establish maximum diameter limits based on pine species and site quality for stands managed with uneven-aged regeneration methods. Habitat Management Areas would produce woodpecker habitat and timber products on a sustained-yield basis.
- Emphasize thinning to reduce southern pine beetle risk and enhance RCW habitat.
- Emphasize prescribed fire, including growing season burns, to control midstory vegetation in pine and pine-hardwood forest types throughout HMAs, especially within clusters.
- Establish criteria to assure adequate foraging habitat (6350 pine trees greater than 10" diameter, 25 years old or older within 1/2 mile of and connected to the clusters.)
- Permit a wide range of regeneration methods. Use of various silvicultural practices would be based on balancing current RCW habitat needs with existing stand condition, site quality, and regeneration of the forest which will provide future habitat.

- o Limit regeneration of the oldest 1/3 of pine and pine-hardwood acres until rotation age. This will ensure suitable potential cavity trees in the shortest time.

- o Encourage restoration of longleaf and other desirable pine species in areas where they occurred historically and would provide better habitat for the RCW.

- o Establish monitoring requirements to determine if the objectives of the new RCW management direction are being met.

- o Require monitoring intensity be linked to population size and vulnerability of the RCW population.

- o Include implementation (quality control), effectiveness (systems control), and policy validation (mission control) monitoring.

(2) Immediately amend 11 Forest Plans through the Record of Decision (ROD) to identify and delineate tentative RCW Habitat Management Areas (HMA) totaling approximately 2 million acres. The affected National Forests where RCW occur are: Alabama, Chattahoochee-Oconee, Cherokee, Daniel Boone, Croatan and Uwharrie, Florida, Francis Marion, Kisatchie, Mississippi, Ouachita, and Texas. The ROD would also establish an implementation time line for the national forests to amend or revise their Forest Plans to incorporate the specific elements of the Revised Handbook.

Tentative HMAs would include suitable RCW habitat between the 3/4-mile radius circles around active and inactive clusters currently protected by Interim Standards and Guidelines (S&Gs). The Interim S&Gs will remain in effect within the 3/4-mile radius circles until individual Forest Plans are amended/revised to incorporate the Revised Handbook. This will be accomplished within one to three years.

Within the tentative HMAs, but outside the 3/4-mile radius circles, current Forest Plan standards and guidelines will remain in effect, except only the following silvicultural systems and practices will be allowed:

- o Thinning.

- o Irregular shelterwood method (two-aged).

- o Single-tree and group selection methods (uneven-aged).

- o Clearcutting method (even-aged) would be allowed to restore longleaf, shortleaf, or other desirable native pine species to appropriate sites currently occupied by trees less suitable for the RCW. This would require a site-specific environmental analysis showing no detrimental effect to the RCW. If a Forest chooses to begin restoration during the transition period between the issuance of the ROD and their Forest Plan amendment or revision, the Forest must first identify sufficient recruitment stands and foraging habitat to meet their tentative population objective identified in Table 2-E1 of this FEIS.

The tentative HMAs and accompanying direction will remain in place until individual Forest Plans are amended/revised to incorporate the Revised Handbook.

Regardless of alternative selected, the National Forests in Texas present a special case.

In 1988, the Sierra Club and the Texas Committee on Natural Resources amended an ongoing suit (originally captioned Sierra Club v. Block, now Sierra Club v. Glickman) against the National Forests in Texas to include allegations that the Forest Service's management practices "jeopardized" the RCW and constituted a "taking" of the RCW in violation of the Endangered Species Act (ESA) Sections 7 and 9 (16 USC 1536, 1538). The District Court found the Forest Service in violation of Sections 7 and 9 of the ESA and ordered the Forest Service to use modified uneven-aged timber management on areas of the forests within 1200 meters of RCW clusters. The order affected about 33% of the acreage on the National Forests in Texas.

In March 1991, the Fifth Circuit Court of Appeals affirmed the District Court as to the ESA violations, but vacated that part of the District Court's order that mandated specific management for the RCW. The Circuit Court ruled that the Forest Service was to propose a plan and consult with the Fish and Wildlife Service on it pursuant to the ESA. The District Court is then to review the plan and shall approve it unless the Court concludes the Forest Service was arbitrary and capricious in developing the plan. The Forest Service decided to adopt Interim Standards and Guidelines for the Protection and Management of the RCW Habitat Within 3/4 Mile of Colony Sites (Interim S&Gs), in place in the rest of the Region since May 1990. (See description of Phase 2 at page xxxviii.) Following consultation, and receipt of a "no jeopardy" opinion by the FWS, the Forest Service submitted the plan to the court in June, 1992. In March, 1994 the District Court rejected the Interim Standards and Guidelines as they pertain to the National Forests in Texas because they included even-aged forest management. The District Court's rejection has been appealed to the Fifth Circuit Court of Appeals. To date, there has been no ruling by the Fifth Circuit.

The Forest Service intends the proposed action to apply in the National Forests in Texas. Unless and until the National Forests in Texas are allowed by the courts to apply this direction, it must continue to manage those portions of the Forest within 3/4-miles radius of RCW clusters in accordance with the District Court's 1988 orders. However, the National Forests in Texas would implement those aspects of this EIS strategy that are not in conflict with, or compromise the court-ordered plan. The following elements of the strategy would be implemented:

1. Monitoring guidelines that include trapping, handling, and banding of RCW.

2. Cluster improvement guidelines that recommend the expansion of the cluster size to 10 acres, from the FSH 2609.23 guide for a buffer of 200 feet around the nest trees.

3. Cluster protection guidelines that recommend predator control of snakes, flying squirrels, etc.

4. Cluster monumentation guidelines that recommend improvement from the FSH 2609.23 guidelines.

5. Cluster improvement guidelines that recommend installation of artificial cavities as needed.

6. All standards and guidelines applicable to Habitat Management Areas (HMA) on land outside the 1200 meter (3/4 mile) zones as identified in the Forest Land Management Plan by amendment or revision.

The following discussions elaborate on the activities of the Revised Handbook and the immediate action.

THE REGIONAL DIRECTION

The Handbook would be revised and the Regional Guide amended through the ROD, but would not be implemented until the national forests with RCW populations have individually amended or revised their Forest Plans. As part of the agency's proposed action, the Southern Regional Guide would be amended to incorporate the revised handbook. Within one to three years, depending on each National Forest's amendment or revision schedule, the affected Forest Plans would be amended or revised to incorporate the Revised Handbook/Regional Guide amendment.

Habitat Management Areas and Population Objectives

The Forest Service would incorporate into the Revised Handbook criteria for the establishment of Habitat Management Areas for all active populations of RCW on the national forests. The HMAs would range from 6,150 acres to 140,000 or more contiguous acres of suitable RCW habitat (pine or pine/hardwood forest types). The location, shape, and size of each HMA would be determined by location, distance and habitat type between existing active and inactive clusters. Each HMA would contain clusters within three to five miles of each other depending on habitat suitability. A detailed description of HMA delineation and population objective determination criteria is contained in Appendix A (which is an integral part of the proposed action). These areas would be managed for multiple uses in a manner that will provide high quality habitat for the RCW. The HMA concept is based on research (Margules et al. 1988, Saunders et al. 1991), conducted since release of the 1985 Fish and Wildlife Service Recovery Plan and the Forest Service Handbook revisions.

The HMA concept would extend RCW management from the cluster area and current 3/4-mile zone to the landscape level. Specific population objectives would be adopted for each HMA based on the area (acres) of suitable RCW habitat within the HMA. Each RCW population would be designated as a recovery or support population. Recovery populations were identified in the 1985 RCW Recovery Plan and would be managed to provide habitat for at least 500 groups, or as many groups as the habitat can support if enough suitable habitat does not exist to support 500 groups. Support populations would be managed for 50 or more groups.

Management Intensity Levels (MIL)

The Forest Service proposes to incorporate a risk classification strategy into the Revised Handbook. This strategy would classify RCW populations by risk of extirpation and manage HMAs in each risk category differently. The Handbook would establish four different Management Intensity Levels (MILs) based on the RCW population size and trend. These levels are assigned numbers corresponding to the risk of extirpation faced by the RCW population in the HMA.

The MILs would be the basis for designing the specific management strategy to recover and protect the RCW in different HMAs. The MIL concept is based on research which indicates small, widely dispersed populations are more susceptible to extirpation (Gilpin and Soule 1986, Goodman 1987).

The MIL concept varies the level of management and protection to the survival needs of different populations depending on their size and trend. This is similar to the way a hospital manages its patients according to the severity of their illness or injury: emergency, intensive care, general care, and outpatient services. The MIL breakdown for recovery populations with a sufficient land base to support 500 groups on national forest lands is shown in Table 1-1. A modified MIL criteria would be used for recovery populations which do not have adequate area to support 500 active clusters and for support populations (those RCW populations other than identified recovery populations).

Management Intensity Levels will be monitored and reassessed for possible reclassification on an annual basis. The reassessment will be based on the average RCW population over the previous five years. For example, a severe risk (MIL 3) population of 120 breeding groups that was previously declining is stabilized and grew by 10 over the 5-year period would be reassigned as moderate risk (MIL 2). The HMA would then be managed under MIL 2 guidelines.

The MIL can be adjusted up or down depending on whether the population is increasing or decreasing.

Table 1-2 briefly summarizes the different MILs and management practices associated with each.

Table 1-1
Proposed Management Intensity Level Criteria for Recovery Populations
Active cluster equivalents should be used when lacking accurate reproduction data to determine MIL for a population or subpopulation.

Management Intensity Level	Reproducing Population*	Potential Breeding Pairs**	Active Clusters***
MIL 1 (Recovered/Low risk)			
A reproducing population size of: with a stable or **increasing** population trend.	≥ 250	≥ 400	≥ 500
MIL 2 (Moderate risk)			
A reproducing population size of: with a **decreasing** population trend; or	≥ 250	≥ 400	≥ 500
A reproducing population size of: with a **stable or increasing** population trend.	125-249	200-400	250-500
MIL 3 (Severe risk)			
A reproducing population size of: with a **decreasing** population trend; or	50-249	80-399	100-499
A reproducing population size of: with a **stable** or **increasing** population trend.	25-124	40-199	50-249
MIL 4 (Extreme risk)			
A reproducing population size of: **regardless of trend**; or	< 25	< 40	< 50
A reproducing population size of: with a **decreasing** population trend.	25-49	40-79	50-99

* Number of groups fledging young annually based on a five-year running average.
** Number of groups with potential breeding pairs (excludes single-bird groups) based on a five-year running average.
*** Total number of groups regardless of breeding status.

Table 1-2
Summary of Proposed RCW Management by MIL.

The RCW populations facing higher risk of extirpation are given progressively higher levels of habitat protection.

Risk Level Criteria	RECOVERED MIL 1 *	MODERATE RISK MIL 2 *	SEVERE RISK MIL 3 *	EXTREME RISK MIL 4 *
Population** Size & Trend	≥250 increasing or stable.	≥250 decreasing or 125-249 increasing	50-249 decreasing or 25-124 stable/ increasing	<25 all trends or 25-49 decreasing
Rotation Age (Years for various pines)***	120 Years-longleaf/ shortleaf, 100 Years-loblolly/slash, 70 Years-Virginia Pine, 80 Years-loblolly/shortleaf in SPB areas	Same as MIL 1	Same as MIL 1	Same as MIL 1
Silvicultural Practice***	A wide range of Silvicultural options allowed, including even-aged and uneven-aged methods	Similar to MIL 1, but emphasizes irregular shelterwood leaving 6 trees per acre or uneven-aged methods	Similar to MIL 2, but leaves 25-30 BA of pine in irregular shelter-wood areas	Similar to MIL 3, but leaves 40 BA of pine in irregular shelterwood areas
Maximum Regeneration Patch Size***	40 acres	40 acres	25 acres	25 acres
Nesting Habitat Provision	Extended rotations, and replacement stands.	Extended rotations, replacement and recruitment stands, and an average of 6 potential cavity trees per acre would remain in regeneration areas.	Same as MIL 2, except that 25-30 BA of pine trees would remain in regeneration areas	Same as MIL 2, except that 40 BA of pine trees would remain in regeneration areas
Fragmentation Prevention***	Extended rotations, regeneration method and patch size limits. **	Same as described for MIL 1 ***	Same as described for MIL 1, plus no even-aged mgmt. within 1/4 mile of active clusters. ***	Same as MIL 3. ***
Prescribed Burning	Where possible, prescribed burning will be used intensively in all MILs to aid in reduction/control of midstory vegetation in RCW habitat. Other control methods, manual, mechanical or chemical may be necessary.			

* When an RCW population is reassigned to a new MIL, the management practices for the newly assigned MIL would be implemented until monitoring indicates another change is in order.

** All population sizes refer to number of actively breeding RCW groups. Actual number of active groups may be greater.

*** Extended rotations, regeneration method and stand size limits listed for each MIL all contribute in reducing RCW habitat fragmentation.

Rotation Lengths and Maximum Diameter Limits

The Forest Service proposes to incorporate extended rotation lengths into the Revised Handbook. Rotation age is the number of years required to grow trees to a desired condition. It applies only to stands managed with even-aged and two-aged silvicultural systems, and would apply to pine and pine-hardwood forest types within HMAs under these systems. The longer rotations would provide sustainable habitat for the RCW, ensure an adequate supply of potential cavity trees, and reduce the potential for fragmentation of RCW habitat. Rotation also affects the number of acres which can be harvested. The longer the rotation, the fewer acres which may be regenerated in a given time period.

The proposed rotations range from 70 to 120 years, depending on pine species. Specific rotation lengths are displayed in Chapter 2.

Uneven-aged methods use a maximum diameter limit and other criteria to determine which trees will be harvested. With uneven-aged methods, the maximum diameter limit set must be capable of producing potential cavity trees. In general, it takes longer to grow potential cavity trees with uneven-aged methods than even-aged methods because of competition for light, nutrients, and growing space. Platt et al. (1988) determined it may take 70 years or more to grow foraging-size (10" DBH) trees in an uneven-aged system in south Georgia. If a 100-year-old tree is needed to achieve potential cavity tree characteristics, the maximum diameter limit must be set so that 100+ year-old trees are produced. Maximum diameter limits may vary from stand to stand, depending on site quality.

Regeneration Patch Size

The Revised Handbook would prescribe maximum stand size openings of 40 acres in HMAs classified as low or moderate risk (MIL 1 and MIL 2) and 25 acres in severe and extreme risk HMAs (MIL 3 and MIL 4), if the stands are managed with even-aged or two-aged silvicultural systems. There is no maximum size for stands managed with uneven-aged methods.

Silvicultural Systems

The Forest Service proposes to incorporate a variety of silvicultural systems, methods, and practices into the Revised Handbook. Different silvicultural practices may be implemented in different HMAs depending on the size and trend of the RCW population being managed and specific management objectives.

Clearcutting Method for Even-aged RCW Habitat

Clearcutting is the removal of all trees from a stand (main canopy level) in a single cutting operation. This method would be allowed to regenerate Virginia and pitch pine, or restore longleaf or other pine species desirable to RCW, to appropriate sites currently occupied by an "off site" species such as slash or loblolly pine. Restoring these pine species on appropriate sites would expand future habitat for the RCW. Any decision to clearcut must be based upon the finding that there will be a definite long-term benefit to and no short-term adverse effects on RCW.

Clearcutting may be used to meet specific RCW management objectives in any HMA or MIL.

Seed-tree and Shelterwood Methods for Even-aged RCW Habitat

Seed-tree and shelterwood regeneration methods leave a number of seed trees distributed over the regeneration area to provide seed for the new stand of trees. Normally a seed-tree area will retain approximately 6-12 square feet of basal area, while shelterwood areas will retain 20-30 square feet of basal area. The seed trees are removed after the new seedlings are securely established, usually within 3-5 years.

The Revised Handbook would allow seed-tree and shelterwood methods in HMAs classified as MIL 1.

Irregular Shelterwood Method for Two-aged RCW Habitat

Irregular shelterwood methods leave all or part of the seed trees standing for an extended or indefinite period. These seed trees may provide the RCW with potential cavity trees, additional foraging trees, and a reduction in habitat fragmentation potential.

The Revised Handbook would permit irregular shelterwood within all HMAs and would vary the number of seed trees retained based on MIL:

(MIL 1) Retain six trees per acre (optional).

(MIL 2) Retain at least six trees per acre.

(MIL 3) Retain 25 to 30 square feet of pine basal area but not less than 10 trees per acre from overwood.

(MIL 4) Retain 40 square feet of pine basal area.

In longleaf, once regeneration is established, the seed trees should be reduced to six potential cavity trees and/or relicts per acre to reduce competition and allow the young longleaf seedlings to grow. These trees are best retained in clumps.

Single-tree and Group Selection Methods for Uneven-aged RCW Habitat

The single-tree and group selection methods would have trees of each age and/or size class intimately mixed together. Single-tree selection involves the removal of scattered individual trees from a stand at relatively short intervals. Group selection is the removal of scattered small groups of trees, 1/4 to 2 acres in size, from a stand at relatively short intervals. The Revised Handbook would allow single-tree and group selection silviculture in all HMAs and MILs.

Midstory Control

Midstory vegetation interferes with the RCW's foraging and movement through the forest. The birds prefer clear flightlines between their cavity trees and foraging trees; the midstory vegetation clutters these flightlines and can force RCWs to abandon their cluster. Heavy hardwood midstory also can increase the number of nest competitors, such as flying squirrels (Loeb 1993).

The RCW and the open pine forests of the Southeast are adapted to periodic fire. Historically, the frequent natural fire cycle in these ecosystems controlled much of the midstory vegetation. Over much of the RCW's range, these fires occurred during the growing season. Prior to the late 1940's, fire prevention and suppression was a primary concern of the Forest Service. In the late 40s and early 50s, prescribed burning of the forest was resumed on some National Forests. However, hardwoods in many pine stands were already too large to be controlled by fire.

The Forest Service proposes to control midstory vegetation throughout the HMAs. The primary tool for midstory control is prescribed burning which mimics the natural fire cycle. The Revised Handbook would require prescribed burning on a two- to five-year cycle after the new age class of pines reach a fire-resistant stage and emphasize growing season burns. Where the midstory vegetation is too large to be controlled by prescribed burning, the Revised Handbook would prescribe other methods such as chemical, mechanical, or manual control. (See details in Chapter 2, Alternative E.)

Monitoring

Monitoring is an ongoing process of measuring change over time and an essential part of implementing Forest Plans and projects. Current conditions supply baseline data which are compared to future conditions. Effective monitoring requires knowing what to measure and how precise these measurements need to be.

Monitoring is an integral part of Forest Planning activities and is specifically required by the National Environmental Policy Act (NEPA) 40 CFR 1505.2(c) and 1505.3 and the National Forest Management Act (NFMA) 36 CFR 219.12 (K).

The monitoring requirements of the proposed action are based on the Forest Service Handbook 1909.12(6) which describes variable monitoring levels relevant to the risks, costs and values involved. The Forest Service requires monitoring to assure each project is designed correctly, carried out properly, and whether the underlying assumptions used in the design are relevant. Each National Forest would monitor RCW habitat, management, and recovery through their Forest Plans and present these findings in monitoring and evaluation reports.

IMMEDIATE ACTIONS

As previously stated, the revised Handbook will not be implemented until the individual Forest Plans are amended/revised. This may take from one to three years. This approach is being used because it responds to the recovery needs of the RCW across its range, while allowing individual forests the flexibility to integrate RCW management with the full range of other multiple uses, and the social and economic factors specific to a greographic area. Decisions to be made in the Forest Plan amendments/revisions include but are not limited to: final HMA delineation, determination of allowable sale quantity, determination of rotation ages to use (including whether to use the southern pine beetle option in loblolly and shortleaf pine), and the mix of regeneration methods to be used to accomplish RCW objectives. It is felt that immediate action is needed to ensure existing RCW are conserved and future management options for the RCW within the areas that will become HMAs are not lost before the amendments or revisions are completed.

Therefore, the Forest Service proposes to amend Forest Plans on the 11 National Forests where RCW are found (see Table 1-4) immediately through the Record of Decision. These amendments would identify and delineate tentative HMAs following the process described in Appendix A. The final HMAs will be delineated through the Forest Plan amendments/revisions and may differ from the tentative HMAs.

Two management strategies will be implemented within the tentative HMAs simultaneously. Within the 3/4-mile radius circles around active and inactive clusters, current direction (Interim S&Gs) will remain in effect. This strategy will ensure that existing RCW are not jeopardized.

Within the tentative HMAs, but outside the 3/4-mile radius circles, current Forest Plan standards and guidelines will remain in effect, with the following silvicultural systems and practices allowed:

- Thinning
- Two-aged silviculture (irregular shelterwood)
- Uneven-aged silviculture (single-tree and group selection)
- Even-aged silviculture (clearcutting) may be allowed to restore longleaf or other pine species desirable to the RCW. This action would require a site-specific environmental analysis showing no detrimental effect to the RCW. Sufficient recruitment stands and foraging habitat must be identified to meet tentative population objectives listed in Table 2-E1 of this FEIS, before any clearcutting can occur.

This strategy will ensure that future management options for the RCW, within the tentative HMAs, are not lost.

Existing Forest Plan rotations, allowable sale quantities, etc., would not be changed until individual Forest Plans are amended or revised.

Both of these management strategies would remain in effect until individual Forest Plans are amended/revised to incorporate and implement the revised Handbook/Regional Guide amendment.

Table 2-E1 shows the acreage for the tentative HMAs and the tentative population objectives for each. Appendix D contains maps showing the tentative HMAs. Figure 2-E1 illustrates how this strategy may appear when implemented on the ground.

PURPOSE OF AND NEED FOR ACTION

The purpose of and need for a Revised Handbook for RCW management is presented in two parts:

(1) Biological evaluation summary.

(2) Relationship to other documents and laws.

The Forest Service proposes to revise the Regional Wildlife Habitat Management Handbook (Handbook), amend the Southern Regional Guide (Regional Guide), and amend affected Forest Plans with new management direction for the endangered red-cockaded woodpecker. The proposed action has several elements and levels of implementation. The Revised Handbook/Regional Guide Amendment would establish criteria to delineate RCW Habitat Management Areas and determine population objectives and establish standards and guidelines for management within HMAs. This direction would be implemented on each affected forest when incorporated in the Forest Plan by amendment or revision.

The purpose of the proposed action is twofold:

(1) Manage RCWs and their habitat so existing populations may be conserved.

(2) Improve habitat throughout identified HMAs to aid recovery of the species by:

(a) Managing 12 RCW recovery populations on Forest Service lands to increase to or beyond 400 potentially breeding pairs (USDI 1985).

(b) Managing 14 RCW support populations to increase to or beyond 40 potentially breeding pairs.

Biological Evaluation Summary

Red-cockaded woodpecker populations have significantly declined throughout much of its range due to a variety of factors, which are discussed later in this section.

The RCW is listed as an endangered species and protected by the Endangered Species Act (ESA). Under the ESA, the Forest Service must not jeopardize endangered species and must carry out programs for their conservation. 16 USC 1536 (a).

In 1985 the Fish and Wildlife Service identified 15 RCW "recovery" populations and established a population objective of 250 "actively breeding pairs" for each (Lennartz and Henry, Pers. Comm.). These objectives are based on the numbers needed to provide a genetically sustainable population.

The Forest Service has primary responsibility to manage RCW recovery, because approximately 51 percent of known active clusters occur on National Forest System lands (F.C. James, personal communication).

Further, 12 of the 15 recovery populations are entirely or in part dependent on National Forest System lands. Table 2-E1 shows the 1994 population, tentative population objective, and the area within the tentative HMAs for each RCW population on National Forest. RCW populations are referred to by the name of the National Forest or ranger district where they occur.

Recovery populations need increased protection and management because:

- Only one recovery population (Apalachicola) currently meets Fish and Wildlife Service criteria as being recovered.
- Two recovery populations (Francis Marion and Vernon) have between 150 and 499 active clusters.
- Four recovery populations (Bienville, Croatan, Oakmulgee, and Sam Houston) have between 50 and 149 active clusters.
- Five recovery populations (Conecuh, DeSoto, Oconee, Osceola, and Talladega/Shoal Creek) have fewer than 50 active clusters, the minimum necessary for short-term viability, and face extreme risk of extirpation.

There are also 14 support populations (RCW populations other than those needed for recovery as identified in the Recovery Plan) on National Forest System lands. Of these, 12 have fewer than 50 active clusters. Forest Service surveys showed 6 of the total 26 populations on National Forests are declining (based on 1993 and 1994 data).

Population declines are caused by a combination of adverse factors, the four primary causes being:

(1) Lack of midstory vegetation control

Conner and Rudolph (1989) confirmed earlier studies that identified midstory vegetation encroachment, blocking cavity entrances and flight lines, as a key cause of cluster abandonment. Loeb (1993) stated midstory control around individual cavity trees is not sufficient to keep southern flying squirrels from RCW cavities.

The RCW is adapted to open pine and pine-hardwood forests where the midstory vegetation was controlled by naturally occurring fire. The near exclusion of fire has led to the growth of midstory vegetation, which Hooper et al. (1980) identified as a major cause of cluster abandonment. Under Interim S&Gs the Forest Service has completed midstory control for all active clusters. Efforts are still underway to complete midstory control for all inactive clusters.

(2) Shortage of cavity trees

Lennartz and Henry (USDI Fish and Wildlife Service 1985) confirmed earlier studies that showed mature pines Infected by redheart fungus were very desirable for RCWs to make their home (Jackson 1977, Conner and Locke 1982). Redheart is not typically abundant in pine trees younger than 80 years old.

Many populations do not have an adequate number of potential cavity trees due to past forest practices (prior to Forest Service acquisition of the land). Most existing cavities are in relict trees, those trees left during the massive timber cuts of the early 1900's, prior to Forest Service ownership. These relicts are often 30 to 40 or more years older than the stands in which they occur.

The new stands growing up around these relicts are often too young to provide new cavity trees, and the remaining relicts are susceptible to windthrow and lightning. Relict trees are dying faster than younger trees can grow to replace them. Management since 1979 has provided future cavity trees by protecting small stands of older pine trees (recruitment stands) near active clusters. For a variety of reasons, the recruitment stand strategy has been unsuccessful. Frequently, the oldest stands available were still too young to be potential cavity trees. Also, since most RCW populations were declining, there was no population expansion and therefore no need for existing RCW to move to recruitment stands. Recruitment stands enhanced with artificial cavities and midstory control have been readily occupied.

In the short-term, the lack of suitable cavity trees can be mitigated with artificial cavities. In the long-term, potential cavity trees can be provided through lengthening rotations, protecting existing relict trees, continuation of the recruitment stand strategy, and protecting significant areas of existing older aged trees through the first rotation. These measures will ensure potential cavity trees in the shortest period of time. As RCW populations increase, the number of options to provide future cavity trees could be reduced.

(3) Habitat loss and fragmentation

The loss and fragmentation of RCW habitat can be divided into two distinct time periods. The initial and most serious fragmentation resulted from the clearing, farming and massive timber cutting activities which began with the arrival of the first European settlers and continued throughout the 1920s and 1930s. These activities almost certainly resulted in dramatic declines in the RCW population across its range.

The 11 National Forests included within the scope of this analysis were established between 1907 and 1937. Most of the lands had been cut over, burned over, eroded, and generally had few existing trees at the time of acquisition. For example, early timber management plans for the Francis Marion and Apalachicola National Forests, indicate an average of only 18 and 9 sawtimber size trees (10 inch diameter and larger) per acre, respectively. Analysis of 1935 aerial photos of the Vernon Ranger District of the Kisatchie National Forest indicated one sawtimber size tree per acre (Hooper, unpublished data). These National Forests as they exist today are the result of intensive fire protection and reforestation efforts which took place primarily between 1911 and 1933.

Two factors have continued to contribute to habitat fragmentation after establishment of the National Forests.

The first factor is land ownership patterns. Few National Forests are made up of large contiguous blocks of federal ownership. Most of the 11 National Forests in this analysis are made up of mosaics of federal and private ownership. Often the private inholdings are managed in a manner not conducive to providing RCW habitat. These disjunct ownership patterns, in some cases, may retard or prohibit some RCW populations from reaching recovery levels.

The second factor involves past forest management practices on National Forests. The Forest Service has emphasized protecting individual RCW groups and associated foraging habitat, usually 125 acres of pine or pine-hardwood meeting specific criteria. This approach usually sustained large RCW populations where the foraging areas often overlapped. However, in small populations where RCW groups were widely dispersed, forest management practices outside the clusters and designated foraging habitat contributed to the isolation of clusters from each other, and populations continued to decline.

(4) Demographic Isolation

Here, the word demographic specifically refers to the spatial distribution of RCW clusters throughout the forest. It was not until Walters et al. (1988a) and Conner and Rudolph (1991a) studied the impact of demographic isolation and habitat fragmentation in North Carolina and Texas, respectively, that the effects of these factors on the RCW were recognized. These studies conclude that habitat fragmentation between demographically isolated RCW clusters limited the expansion of groups and contributed to their extirpation. Continued implementation of the Interim Standards and Guidelines which manages 3/4-mile radius circles around RCW clusters could lead to, or reinforce existing demographic isolation problems in smaller populations.

Hooper and Lennartz (1995) found that only in low density populations (less than 5 RCW groups within 1.25 miles of each other) did the relative availability of foraging habitat seem to be a factor in population viability. They also suggest that low population density, itself, may be a major factor inhibiting expansion of some small RCW populations, regardless of habitat quality.

Conner and Rudolph's (1991a) study indicates the effect of fragmentation decreases as the level of demographic isolation decreases, i.e., population densities increase. The continued decline of the RCW in many areas, especially the smaller and more widely dispersed populations show the need for: (1) Direct intervention through the use of artificial cavities and translocation of RCW; and (2) the management of relatively large contiguous blocks of land to reduce potential for habitat fragmentation, ensure demographic stability, and recovery of the RCW.

Relationship to Other Documents and Laws

This Environmental Impact Statement (EIS) is prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), which requires federal agencies to evaluate and disclose the environmental impacts of proposed federal actions. This EIS will result in a "programmatic" decision, from which other, more site-specific actions will "tier" their environmental analysis. (See 40 CFR 1502.20.)

Two other laws play key roles in the preparation of this EIS. The first is the Endangered Species Act (ESA). The ESA requires all federal agencies to take appropriate steps to conserve threatened and endangered species. It further requires all federal agencies to coordinate their activities with the U.S. Fish and Wildlife Service to ensure endangered species are not jeopardized by agency actions, 16 USC 1536 (a).

The Endangered Species Act of 1973 provides legal protection to the RCW, which was listed as endangered in 1970. This EIS is a continuation of the Forest Service's efforts to define those measures necessary to protect, conserve, and recover RCW on National Forest System lands. The Forest Service entered into formal consultation with the Fish and Wildlife Service on the proposed action presented in this environmental impact statement. Formal consultation involves submission of the proposed action to the Fish and Wildlife Service, which will prepare a biological opinion in which they state whether the proposed action is likely to jeopardize the continued existence of listed species.

The other law related to the decisions being made with this EIS is the National Forest Management Act (NFMA). The NFMA implementing regulations requires development of a regional guide for each Forest Service region to "provide standards and guidelines for addressing major issues and management concerns which need to be considered at the regional level to facilitate Forest Planning," 36 CFR 219.8(a). The direction proposed in this EIS would be incorporated into the Southern Regional Guide to ensure sufficiency and uniformity of RCW management and protection in Forest Plans. Each Forest Plan establishes a programmatic framework for management. It sets general and specific goals and objectives for National Forest management and establishes standards and guidelines to follow in pursuit of those goals. It also establishes monitoring requirements to help determine how well the standards and guidelines are working and whether the goals and objectives are still appropriate. Following issuance of the record of decision for RCW management, the affected Forest Plans will be amended or revised to incorporate the standards and guidelines from the Regional Guide.

Under the programmatic framework established in the Forest Plans, site-specific or project level decisions to manage RCW habitat will be made consistent with the standards and guidelines in the Forest Plans. These decisions require additional site-specific environmental analysis in order to fully meet the requirements of NEPA, ESA, and other environmental laws and regulations.

This EIS also incorporates by reference the environmental analysis for four regional programmatic decisions, which are available for public review at USDA Forest Service offices in the Southern Region.

(1) The Final EIS and Record of Decision (ROD) for the Suppression of the Southern Pine Beetle.

Periodic and severe outbreaks of southern pine beetle occur throughout the range of the RCW. The RCW depends on mature pine trees for nesting and foraging habitat, which are affected by both the beetle and the management of beetle outbreaks. The Forest Service evaluated effects of controlling the beetle and documented those effects in the EIS.

(2) The Final EIS and Record of Decision (ROD) for Vegetation Management in the Coastal Plain/Piedmont.

Eleven identified RCW recovery populations depend on National Forest lands in the coastal plain and piedmont physiographic regions. The Forest Service manages the vegetation which constitutes the RCW's habitat and specifically proposes to use growing season burns to reduce and control midstory vegetation. The Vegetation Management EIS evaluates the effects of various vegetation management practices on the environment, which are similar to the practices proposed in this EIS.

(3) The Final EIS and Record of Decision (ROD) for Vegetation Management in the Ozark/Ouachita Mountains.

A support population of RCWs live in the Ouachita National Forest and have historical range that extends throughout the shortleaf pine forests in the Ozark and Ouachita Mountains. The content and purpose for incorporating this document is the same as for the coastal plain and piedmont.

(4) The Final EIS and Record of Decision (ROD) for Vegetation Management in the Appalachian Mountains.

There is one RCW recovery population on the Talladega National Forest and RCW support populations in the Cherokee, Daniel Boone, and Bankhead National Forests. The content and purpose for incorporating this document is the same as for other Vegetation Management EISs.

This EIS describes those measures necessary to properly manage RCW habitat. However, before any activities can take place on National Forest System lands, they must be found consistent with the direction in the affected Forest Plans. This EIS will evaluate measures in the form of a revised Regional Handbook and immediate actions needed to manage the RCW to meet the ESA requirements, which will be incorporated into the Forest Plans through either an amendment or revision. Decisions to be made in the Forest Plan amendments/revisions include but are not limited to: final HMA delineation, determination of allowable sale quantity, determination of rotation ages to use (including whether to use the southern pine beetle option in loblolly and shortleaf pine), and the mix of regeneration methods to be used to accomplish RCW objectives.

SCOPE OF ENVIRONMENTAL ANALYSIS

The Forest Service is studying a range of alternatives to guide RCW recovery on National Forest System lands in the Southern Region. The proposed action and each alternative consist of different strategies or programmatic policies in the form of regional direction, to help conserve and recover the RCW on the National Forests.

The Forest Service developed the proposed action to guide RCW protection and recovery through consulting with field and research units within the agency, the Fish and Wildlife Service, and the public. This consulting or scoping brought forth issues from which the Forest Service developed alternatives to the proposed action.

The scope of environmental analysis of this EIS includes:

- **The scope of activities comprising the proposed action.**
  What does the Forest Service propose to do? (Chapter 1)

- **The scope of the alternatives to the proposed action.**
  What range of actions are considered in the various alternatives and how do they address the significant issues? (Chapter 2)

- **The scope of the effects analysis on a regional scale.**
  What are the cause and effect relationships associated with the proposed action and considered alternatives? (Chapter 3)

This EIS discloses and evaluates environmental effects caused by the proposed action and alternatives to the proposed action including no action. This EIS presents possible direct, indirect, and cumulative effects of these actions on the environment. The analysis addresses effects of previous decisions in the context of their contribution to cumulative effects.

This EIS analyzes Regional effects and does not disclose environmental effects with sufficient precision to incorporate the new Regional Direction directly into each Forest Plan without further analysis. Nor does this EIS disclose site-specific analysis for individual projects which will occur later through the implementation of individual Forest Plans.

DECISIONS TO BE MADE

The Regional Forester will decide how and where the Forest Service will manage National Forest System lands to protect and conserve the red-cockaded woodpecker.

The decisions to be made are:

(1) Whether to amend the Regional Wildlife Habitat Management Handbook and Regional Guide to establish new Regional direction for the management of the RCW.

(2) Whether to amend immediately the Forest Plans on all National Forests with RCW to identify and delineate tentative Habitat Management Areas (HMA) and implement specific forest management activities within these tentative HMAs.

ISSUES AND PUBLIC INVOLVEMENT

The proposed action is intended to avoid jeopardizing the species and help conserve and recover the RCW on National Forest System lands. The decision to proceed with the proposed action, an alternative action, or no action brings forth several issues which need to be considered. The issues were identified early in the analysis process in order to use them to develop alternative ways to conserve and recover the RCW.

An important part of any environmental analysis is to identify issues associated with the proposed action. The Forest Service uses a process called "scoping" to determine the issues to be addressed in the environmental analysis and to identify significant issues related to the proposed action. The scoping process is managed by the interdisciplinary team (ID team) and the responsible official (Regional Forester in this case), who determines whether or not the issues generated are significant to the proposed action.

The Forest Service initiated the scoping process regarding this proposed action before the Interim S&Gs (see page xxxviii) had been developed. The Federal Register published the Notice of Intent (NOI) to prepare an environmental impact statement on May 5, 1989 and an amended Notice of Intent on October 29, 1991.

The ID team was preparing the Environmental Assessment (EA) for the Interim S&Gs during that period and its scoping brought forth similar issues. The decisions to adopt the Interim S&Gs was signed by the Regional Forester May 9, 1990. Interim S&Gs were extended to the Kisatchie and Apalachicola National Forests when a supplement to the original environmental assessment was signed May 3, 1991.

External scoping communicates with interested and affected individuals, other federal, state, and local agencies, organizations, and private companies. When the Forest Service sent more than 17,300 external scoping letters regarding both the Interim S&Gs and this proposed action, the letters invited the readers to reply and express concerns and issues. The combined scoping is appropriate as the proposed action and the Interim S&Gs both deal with management of RCW habitat. Subsequent external scoping included news articles and public forums on RCW management.

The Forest Service received 485 total external responses, a 2.8 percent reply rate. The RCW interdisciplinary team reviewed all responses but placed more emphasis on those in response to the Oct. 29, 1991 Notice of Intent.

Internal scoping communicates with various professionals and managers within the Forest Service. The Forest Service team conducted internal scoping throughout development of Interim S&Gs and the proposed action. The team has received comments from biologists, silviculturists, soil scientists, hydrologists, planners, and wildlife researchers throughout the Region.

The interdisciplinary team clarified and grouped issues by common resource and cause and effect relationship. The team identified eight significant issues that needed detailed study in the EIS.

Significant issues are those which have wide geographic effects, have long-term effects, or are highly controversial and create a high level of public interest. The interdisciplinary team determined other issues to be nonsignificant for this decision because they did not have sufficient geographic extent, duration, or public interest. Some issues may be significant by definition, but have been previously decided by law, regulation, court decision, or national policy direction, or are clearly outside the scope of the decision.

The significant issues were used to develop various alternatives to the proposed action, appropriate mitigation measures and monitoring (Chapter 2). The significant issues are measurable in order to compare the environmental effects for the proposed action and other alternatives (Chapter 3).

Significant Issues

Biological Diversity Issues

The effects of implementing the proposed action and alternatives on biological diversity was identified internally as an issue. Externally, biological diversity issues were more specific resulting in the following three issues.

<u>(1) Red-Cockaded Woodpecker and Populations</u>

Would clearcutting and other even-aged management provided for in the proposed action and alternatives cause habitat loss or fragmentation, or draw the birds into trees subject to high mortality due to lightning and windthrow, and cause RCW populations to decline?

The issue was identified by external and internal scoping. The proposed Handbook revision would limit silvicultural practices such as clearcutting but does not prohibit them except in the clusters.

The team evaluated the impact the proposed action and alternatives would have on:

(a) Spatial arrangement and density per acre of potential cavity trees.
Unit of measure: number of potential cavity trees per acre and how spatially arranged.

(b) Fragmentation control within RCW HMAs.
Unit of measure: percentage of suitable habitat with some degree of tall forest cover.

(2) Proposed, Endangered, Threatened and Sensitive Species (PETS)

Would the proposed action and alternatives cause a decline in habitat quality or affect populations of other PETS such as the Louisiana pearlshell mussel, Louisiana black bear and bald eagle?

The issue was identified by both external and internal scoping. The proposed Handbook revision would call for extending rotation age, reducing midstory vegetation, prescribed burning and thinning, which may impact the various PETS on the National Forests with RCWs.

The team evaluated the impact the proposed action and alternatives would have on:

(a) Habitat quality for PETS.
Unit of measure: relative compatibility of PETS with stand structure resulting from RCW management.

(b) Fire.
Unit of measure: Relative adaptability of PETS to fire-dependent forest ecosystem.

(3) Mast-Dependent Species

How would the proposed action and alternatives affect mast-dependent species, such as deer, turkey, and squirrel?

The issue was identified by both external and internal scoping. The proposed Handbook revision would call for reducing midstory vegetation, some of which are species capable of producing mast such as acorns. The loss of available mast could cause population decline for those species dependent on mast.

The team evaluated the impact the proposed action and alternatives would have on:

Mast production capability.
Unit of measure: Relative impact of midstory vegetation control on mast production capability.

Economic and Social Issues

(4) Volume/Income/Jobs

How would the proposed action and alternatives cause changes in timber volume available for harvest, timber-related jobs, and USDA payments to states?

The issue was identified by both external and internal scoping. The proposed Handbook revision would cause changes in the volume of timber harvested on National Forests where RCWs live. Timber volume from National Forests is linked to timber-related jobs and the economic well-being of many communities.

The team evaluated the impact the proposed action and alternatives would have on:

(a) Available timber volume.
Unit of measure: million board-feet per year, compared to average volumes sold, not Forest Plan allowable sale quantities.

(b) Timber-related jobs.
Unit of measure: jobs per million board feet harvested per year.

(c) Timber-related income.
Unit of measure: dollars per million board feet harvested per year.

(d) The cost of implementing the general habitat improvements that benefit the RCW.
Unit of measure: federal dollars per year.

(e) USDA payments to states.
Unit of measure: dollars per year based on the 25 percent formula, projected timber volumes and prices.

(5) Below-Cost Timber Sales

How would the proposed action and alternatives cause changes in the costs of production and contribute to below-cost timber sales?

The issue was identified by both external and internal scoping. The proposed Handbook revision could cause a decline in the volume of timber harvested. The cost of implementing RCW recovery, the change in volume, and the increased care and monitoring of timber sales could impact the Forest Service's net income received from timber sales.

The team evaluated the impact the proposed action and alternatives would have on:

(a) Projected volume and product mix of harvested timber.
Unit of measure: sawtimber (million board feet per year) and pulpwood (million board feet per year).

(b) Projected cost for sale preparation and harvest administration.
Unit of measure: dollars per thousand board feet.

(c) Projected revenue from timber sales.
Unit of measure: dollars per thousand board feet.

<u>(6) Oil and Gas Exploration and Development</u>

How would the proposed action and alternatives limit access to National Forest System lands for the purpose of oil and gas exploration and development?

The issue was identified by external scoping. The proposed Handbook revision would limit activities in RCW clusters, such as land clearing and right-of-way construction. The Plan's limits may impact oil and gas exploration and development.

The team evaluated the impact the proposed action and alternatives would have on:

(a) Area where surface occupancy for oil and gas exploration and development would be prohibited.
Unit of measure: acres.

(b) Areas open to oil and gas exploration and development with restrictions to protect the RCW.
Unit of measure: acres.

Recreation Issues

<u>(7) Recreation Facilities and Trails</u>

How would the proposed action and alternatives affect use and construction of recreation facilities and trails?

The issue was identified by internal and external scoping. The proposed Handbook revision would limit activities in RCW clusters to avoid disturbing the birds, especially during nesting season. These limits may restrict use and construction of new off-road vehicle trails and other recreation facilities.

The team evaluated the affect the proposed action and alternatives would have on:

(a) New construction of facilities and trails.
Unit of measure: acres unavailable for construction.

(b) Closing existing facilities and trails.
Unit of measure: The analysis was based on relative differences between alternatives in regard to nesting season disturbance.

(8) Wilderness

How would southern pine beetle control in wilderness to protect RCW groups or their foraging habitat provided for in the proposed action and alternatives, affect wilderness attributes and use?

The issue was identified by internal and external scoping. This issue is site-specific to wildernesses, but was considered significant because of the controversial nature of the action. The proposed Handbook revision would not control southern pine beetle in wildernesses to protect wilderness RCW groups or foraging habitat.

However, control could occur in wildernesses to protect RCW groups and foraging habitat outside of wilderness. The wilderness experience may be affected by these activities.

The team evaluated the affect the proposed action and alternatives would have on:

(a) Wilderness attributes and potential visitor use.

Unit of measure: Because of the site-specific nature of this issue and the subjectivity that could be involved in analyzing effects on attributes such as scenic value and apparent naturalness, the analysis was based on relative affects of cutting trees in wilderness.

Physical Resource Issues

(9) Air

How would the proposed action and alternatives cause potential degradation to air quality?

The issue was identified by internal scoping. The proposed Handbook revision would allow significant increases in acres prescribed burned annually and change season of burns. These burning activities may affect air quality.

The team has evaluated the impact the proposed action and alternatives would have on:

(a) Air quality:
Unit of measure: acres burned annually and season of burn.

The interdisciplinary team considered other issues and found them to be non-significant to the decision to be made. This EIS incorporates by reference the (EIS) environmental analyses for southern pine beetle and appropriate vegetation management decisions. Certain issues pertaining to the application of prescribed burning, herbicide use, and southern pine beetle are outside the scope of this analysis, since their use has already been decided in these other Regional decisions and the effects from their use have been disclosed in those documents.

Nonsignificant Issues

(1) How would prescribed burning provided for in the proposed action and alternatives impact human health?

The ID team reviewed the Vegetation Management EISs (Coastal Plain/Piedmont, Appalachian Mountains, and the Ozark/Ouachita Mountains) which address this issue. This issue was significant in terms of the decisions made regarding vegetation management. This EIS incorporates each (Vegetation Management) Final EIS and Record of Decision.

(2) How would prescribed burning provided for in the proposed action and alternatives impact the forest's health and productivity?

The Forest Service documented the historical role of fire and how southern pine forests and animals associated with these forests are ecologically adapted to periodic fires in the Vegetation Management EIS for the Coastal Plain/Piedmont. That EIS disclosed that prescribed burning reduces disease susceptibility, increases the quality of oak sprouts, and stimulates seed production among some legumes (p. IV-35).

Prescribed burning also reduces the fuel load, the dry tinder that can otherwise accumulate and provide fuel for severe wildfires that damage and kill mature trees.

(3) How would cutting of trees in wildernesses to protect RCW cavity trees from southern pine beetles provided for in the proposed action and alternatives impact the wilderness and the RCW?

The Forest Service evaluated various means to protect RCW cavity trees and foraging habitat that occur in wildernesses in the EIS for Suppression of the Southern Pine Beetle. The Record of Decision for the SPB EIS allows the cutting of trees within wildernesses to protect RCW cavity trees and foraging habitat from southern pine beetles (p. 12-13). This decision is consistent with the Endangered Species Act and received a "no jeopardy opinion" from the USDI Fish and Wildlife Service (Southern Pine Beetle EIS pp. II-36).

The Record of Decision requires that a site-specific analysis evaluate potential impacts on the wilderness character before any southern pine beetle control decisions are made (Southern Pine Beetle ROD, p. 13).

(4) How would the proposed action and alternatives cause potential degradation of the soil and water resources?

The ID team evaluated the proposed action and alternatives and determined that the soil and water issue was not significant given the scope and programmatic nature of this analysis. There is the potential for this issue to be significant at the Forest Plan and project levels. Activities that could potentially affect soil and water resources include timber harvest and the associated transportation systems and site preparation. These activities are governed by site-specific factors.

It is not possible to accurately predict or summarize potential effects on soil and water resources because of the site-specific nature of effects and the programmatic nature of this EIS. All alternatives allow for the regeneration of RCW habitat. Alternative B could regenerate the most acres annually and thus potentially have the greatest effect, while Alternative D would regenerate the least habitat. None of the alternatives specify which regeneration method will be used in relation to site factors, and no alternative dictates a standard mixture of methods. The flexibility is maintained to allow site-specific analysis regarding regeneration methods, followed by a site-specific decision document.

An example of the site-specificity involved in potential effects relating to soil and water was identified during the scoping process. An individual responded with specific concerns for the Louisiana pearlshell mussel. The Louisiana pearlshell mussel is only known to exist in a few locations in Louisiana. Any effects on soil or water that could potentially affect this mussel would be site-specific. This would be the case with all aquatic PETS species.

Although it is not possible to summarize potential effects, some generalization can be made in regard to potential effects to soil and water resources. In general, the following should hold true:

- The more intensive the site preparation, the greater the potential for effects on soil and water.

- The more acreage harvested, the greater the potential for effects.

- The more entries into a stand with heavy equipment, the greater the potential for effects.

  Uneven-aged silviculture requires more acres to be treated, more entries into a stand, and recurring use of the transportation system to maintain a balanced uneven-aged stand structure.

  Uneven-aged regeneration can be achieved with low-intensity site preparation.

Individual forests will have the opportunity to tailor their habitat regeneration programs using even-aged, two-aged, and uneven-aged regeneration methods based on site-specific conditions. Disclosure of effects on soil and water resources will occur at the project level.

(5) How would the proposed action and alternatives affect rights-of-way management?

The ID team evaluated the proposed action and alternatives and determined that rights-of-way management was not significant given the scope and programmatic nature of this analysis. There is the potential for this issue to be significant at the individual project level. All alternatives provide for rights-of-way management, but there are differences in alternatives regarding season of work and restrictions in clusters, replacement, and recruitment stands. Site-specific factors that could affect rights-of-way management include location of clusters, distance to cavity trees, foraging habitat availability, and planned season of work.

For example, if an existing road through suitable RCW habitat is to be widened and it is 280 feet to the nearest active cavity tree and foraging is not limited, RCW restrictions should not be necessary. However, if the same road passed within 100 feet of an active cavity tree and foraging was not limited, road widening activities should be scheduled outside the nesting season, in the area of the cluster.

Rights-of-way management will require site-specific analysis and disclosure of effects before project implementation.

(6) How would the proposed action and alternatives affect heritage resources?

The ID team evaluated the proposed action and alternatives and determined that heritage resource management was not significant given the scope and programmatic nature of this EIS.

There is the potential for this issue to be significant at the project level. The National Historic Preservation Act and the Archeological Resources Protection Act require government agencies to manage the heritage resources under their control. Inventory procedures will be followed to assure cultural values are considered in the decision making process. Disclosure of effects on heritage resources will occur at the project level.

PERMITS, LICENSES, AND ENTITLEMENTS

The proposed action does not require the Forest Service to obtain any permits or licenses, but the Endangered Species Act requires coordination and consultation with the USDI Fish and Wildlife Service. The Fish and Wildlife Service as an official cooperating agency has worked with the Forest Service throughout the development of the RCW Regional direction. The Fish and Wildlife Service evaluated the preferred alternative (Regional Direction) and issued a non-jeopardy biological opinion (see Appendix H) before the Record of Decision was signed.

CHAPTER 2

ALTERNATIVES INCLUDING THE PROPOSED ACTION

INTRODUCTION

The management of an area to meet the habitat needs of the RCW and enable recovery is a complex task. When RCW management is overlaid with the management of other forest resources, as required by the National Forest Management Act, the level of complexity is compounded.

The Southern Region of the U.S. Forest Service has developed an array of alternatives in response to the issues raised in Chapter 1. In this chapter you will find:

- The process used to develop the alternatives,
- A description of alternatives considered but not analyzed in detail,
- A description of activities common to three or more alternatives,
- A description of the proposed action and other alternatives analyzed,
- A comparison of how the alternatives respond to the issues identified in Chapter 1,
- Identification of the Forest Service's preferred alternative.

ALTERNATIVE DEVELOPMENT PROCESS

An interdisciplinary team considered the following important elements and information when they developed the alternative for this analysis:

- The goals and objectives needed for recovery of the RCW as outlined in the Fish and Wildlife Service's 1985 RCW Recovery Plan,
- The results of the National Wildlife Federation's 1990 Scientific Summit on the Red-Cockaded Woodpecker (Appendix G, also page xxxvii),
- The analysis for the Decision Notice, Finding of no Significant Impact and Environmental Assessment, Interim Standards and Guidelines for the Protection and Management of RCW Habitat Within 3/4 Mile of Colony Sites and its two subsequent Supplemental Analyses (see page xxxviii),
- Issues identified through external and internal comments received as a result of scoping efforts for both the Interim and the draft environmental impact statement, previously described in Chapter 1,
- Information gathered from recent (since 1985) research and tours of different research and forest management operations throughout the range of the RCW,
- The laws, regulations, and policies that govern land management on National Forests.

Ten alternatives have been considered. Five of these were eliminated from detailed study because they failed to address one or more of the needs for the RCW or did not consider public issues or concerns. These alternatives are described in Chapter 2.

The remaining five, which include the no-action alternative (continued implementation of Interim), were examined in detail for environmental effects upon the general forest area, the RCW, other wildlife, plants, and economic effects upon local communities.

Each alternative would meet the needs of the RCW to some degree. Each would provide foraging habitat, potential cavity trees and relict trees, varied age classes and in each alternative there would be some degree of timber harvesting. All of the alternatives rely upon prescribed burning to maintain the open park-like habitat and the pine ecosystems the RCW prefers. Other wildlife and plants are analyzed within each alternative to show how RCW management may affect them. All alternatives have addressed one or more issues of public concern previously identified in Chapter 1.

LOCATION

The affected forests are: Alabama, Chattahoochee-Oconee, Cherokee, Daniel Boone, Croatan, Florida, Francis Marion, Kisatchie, Mississippi, and Ouachita.

The National Forests in Texas present a special case, remaining under a court-ordered RCW management plan. If the court has not responded by the time this EIS is completed, the Forest Service would submit the revised Handbook (based on the chosen alternative) to the court. Until the court decides whether to approve a new management strategy, the court-ordered plan remains in effect.

How the Alternatives Respond to the Issues

The following is a brief discussion of how the alternatives, briefly described below, respond to the issues identified previously in Chapter 1. For a more detailed discussion, the reader is encouraged to read the Effects section of Chapter 3. The issues are discussed in the same order as described in Chapter 1.

Alternative A is the Interim S&Gs, the direction currently guiding RCW management on all National Forest except the National Forests in Texas. The area managed for RCW is based on 3/4-mile radius circles around all active and inactive clusters.

Alternative B is based on the 1985 Handbook, with modifications to include information which has become available since 1985. RCW management is concentrated on clusters, replacement, and recruitment stands. The area outside these stands would be managed using Forest Plan standards and guidelines.

Alternative C is based on the establishment of HMAs and rotation lengths ranging from 70 to 200 years, depending on tree species and site quality. Rotation length is based on the assumption that longer lived trees growing on good sites develop heartwood at a slower rate. It establishes five MILs and stresses the use of growing season burning to control midstory vegetation.

Alternative D was developed in response to the issue concerning the effect of timber harvest on RCW. There will be no sustained production of forest products, although some cutting of trees will be allowed (thinnings and restoration of desirable pine species) to enhance RCW habitat and reduce the risk of insect outbreaks. There will be no rotations established. Five MILs are established.

Alternative E is based on the establishment of HMAs and rotation lengths ranging from 70 to 120 years. Rotations are based on research on the rate of heartwood development in longleaf and loblolly pine, and analysis of the age of existing cavity trees. It establishes four MILs and stresses the use of fire, including growing season burns, to control midstory vegetation.

Biological Diversity Issues

(1) What are the effects of clearcutting and other even-aged regeneration methods on RCW and the long-term impact of drawing birds into trees subject to high mortality due to lightning or windthrow?

In the short term, clearcutting, if not properly prescribed, can contribute to RCW habitat fragmentation. Alternatives A, C, D, and E will use clearcutting in only a few situations where it is the optimal regeneration method to achieve specific goals. Most of these situations also call for mitigation in the form of leaving some trees in the clearcut area. The standard clearcut, where all trees are cut, will occur infrequently and only to accomplish some specific management goal to benefit the RCW. Alternative B will allow clearcutting within the constraints set by the Chief's letter of June 4, 1992 on ecosystem management.

The use of standard seed-tree and shelterwood regeneration methods, where the seed trees are removed once the new stand of trees is well established, is not allowed in Alternative A or D. These methods are restricted in Alternatives C and E to RCW populations in MIL 1, those having been declared recovered. With populations this large and the prescribed mitigation (maximum cut size and reduced area which can be regenerated due to extended rotations) adverse effects are unlikely. Alternative B will allow both standard seed-tree and shelterwood regeneration. As with clearcutting, these methods can result in habitat fragmentation if not properly prescribed.

The drawing of RCW into trees subject to high mortality refers to the birds putting cavities in the seed trees of seed-tree and/or shelterwood cuts. These trees are often subject to high mortality due to lightning or windthrow. All alternatives will allow such regeneration methods and the irregular shelterwood will be the primary method in Alternatives A, C, and E.

The primary reason RCW are attracted to seed trees is the openness of the stands and more importantly, the lack of midstory. Alternatives A, C, D, and E propose to control midstory in clusters and reduce it over the entire HMA. These activities should produce thousands of acres of desirable RCW habitat, thus reducing the attractiveness of seed trees to the RCW. Alternative B does not propose to reduce midstory over large areas and therefore with this alternative RCW will probably still be attracted to seed trees.

(2) Will the proposed action and alternatives reduce habitat quality and thus affect other PETS species?

The majority of PETS species which occupy habitat similar to that used by the RCW evolved in the same fire-dependent ecosystems as did the RCW. Therefore, the use of fire over large areas as prescribed in Alternatives A, C, D, and E will create better habitat for these species as it will for the RCW. Alternative B only requires burning and maintenance of good RCW habitat within clusters.

Therefore, it would provide less good habitat for other PETS species needing habitat similar to the RCW.

A project-level biological evaluation would be used to determine the potential effect on other PETS species. Such species' needs would take priority over the RCW if it is at a greater risk of extinction. For example, the Louisiana pearlshell mussel, a threatened mollusk, is found in a few streams in Louisiana. If the project-level evaluation found that prescribed burning to maintain RCW habitat adversely affected water quality in these streams, affecting the pearlshell, additional mitigation would be implemented to prevent degrading the water quality. This mitigation would occur even if it meant a reduction in the acres of quality RCW habitat.

(3) How would the proposed action and alternatives affect mast-dependent species, such as deer, turkey and squirrel?

A key element of RCW management is the control/reduction of hardwood and to a lesser degree pine midstory. An understanding of the term midstory is important. It refers to the smaller, shrubby understory trees, not the large dominant and codominant trees in the overstory.

Alternatives A, C, and D call for the elimination of hardwood midstory in clusters. Alternative B calls for removal of all hardwood within 50 feet of cavity trees. Alternative E allows the retention of up to three desirable midstory trees per acre. Alternatives A, B, C, and D allow up to 20 square feet of basal area of overstory hardwoods per acre in clusters. Alternative E allows up to 10 overstory, dominant and codominant, hardwood trees per acre in clusters. The quantity of hardwood to be expected within clusters and the HMAs will vary by forest type. For example the longleaf pine type was historically almost a pure pine forest, therefore the number of hardwoods would be limited. Conversely, those portions of the RCW's range historically occupied by loblolly or shortleaf pines were frequently a mixed pine-hardwood forest; thus the number of hardwoods may be greater.

Alternatives A, C, D, and E call for a reduction of hardwood midstory outside clusters but within HMAs. In these areas, there is no restriction on the quantity of overstory hardwoods which can occur nor is the intent to totally eliminate midstory hardwoods. All alternatives specifically prohibit removal of hardwoods in natural hardwood areas such as stream bottoms and hardwood stringers, unless the continued survival of a RCW group is at stake.

Economic and Social Issues

(4) How would the proposed action change timber volumes available for harvest and thus affect timber-related jobs and USDA payments to states?

Extension of rotation length for RCW habitat management, requirements to provide adequate foraging habitat, and prescribed regeneration methods specified in the proposed action and some of the other alternatives will bring about changes in timber volumes and subsequently timber-related jobs, income, and payments to the states. Projected timber volumes which may be available by alternative and 10-year period for the next 30 years are displayed in Table 2-1. The other aspects of economic effect are described in Chapter 3.

Table 2-1
Estimated Harvest Levels by Alternative and Time Period.
(Millions of Board Feet per Fiscal Year)
In most alternatives available volumes increase with time.

Time Period	Baseline* Volume	Alternatives A	B	C	D	E
Year 1-10						
Sawtimber	503	376(-25)**	401(-20)	334(-34)	313(-38)	396(-21)
Pulpwood	402	336(-16)	345(-14)	336(-16)	291(-28)	344(-14)
	905	712(-21)	746(-18)	670(-26)	604(-33)	740(-18)
Year 11-20						
Sawtimber	503	380(-24)	423(-16)	360(-28)	326(-35)	415(-17)
Pulpwood	402	341(-15)	352(-12)	350(-13)	307(-24)	352(-12)
	905	721(-20)	775(-14)	710(-22)	633(-30)	767(-15)
Year 21-30						
Sawtimber	503	417(-17)	489(-3)	384(-24)	330(-34)	409(-19)
Pulpwood	402	330(-18)	380(-5)	362(-10)	277(-31)	355(-12)
	905	747(-17)	869(-4)	746(-18)	607(-33)	764(-16)

* Baseline volumes are based on the average volume of pine sawtimber and pulpwood harvested from the 11 affected National Forests 1987-89, prior to implementation of Interim S&Gs. The 905 MMBF baseline is a reduction from the baseline used in the DEIS for the following reasons:

1. The current baseline takes into account the devastating effects of Hurricane Hugo on the Francis Marion National Forest. The baseline in the DEIS included 100 MMBF coming from the Francis Marion. Not making an adjustment to the baseline volume to take into account unavailability due to storm damage would attribute the volume reduction under the alternatives to RCW management, not the effect of the hurricane. Eighteen MMBF were included in the current baseline coming from the Francis Marion. This is the volume the Forest estimated could be harvested annually for the first decade under Alternative B, the guidelines that would have been in effect during the baseline period.

2. Current baseline volumes were also adjusted to account from hardwood volumes that were erroneously included in the DEIS baseline. Hardwood volumes will not be affected by RCW management and should not be included in baseline volumes.

The adjustments made for hurricane damage and inclusion of hardwood volumes were made across all alternatives for all time periods as well.

** The number in parenthesis is the percentage change from the baseline volumes.

Another concern expressed is the cost of implementing the proposed action and alternatives. Table 2-2 displays the estimated annual cost of implementing the various alternatives by 10-year period for the next 20 years.

Table 2-2
Estimated Annual Cost of Implementing RCW Management in Millions of Dollars.
Annual cost decrease with time as burning proficiency improves.

Time Period (Years)	Alternatives A	B	C	D	E
1-10	10.68	3.49	14.18	14.18	14.18
11-20	5.61	3.49	7.97	7.97	7.97

(5) Would the proposed action and alternatives cause changes in the cost of sale preparation and administration and thus contribute to below-cost timber sales?

Most National Forests with RCW have traditionally received more money for the timber they sell than it cost to mark the timber and prepare the sale. Only one National Forest, the Daniel Boone in Kentucky, has not made enough money from timber sales to meet expenses (below cost). As a result of implementing any of the various alternatives, a forest could be placed in a below-cost situation. The more extreme economic effects will occur on those forests where present conditions greatly restrict the future options under any alternative.

The National Forests in Florida are representative of this situation. This is due to the current method of calculating foraging habitat (providing 6350 pine stems 10 inches or greater in diameter, versus 125 acres of pine forest meeting specific criteria) and past management practices which allowed thinning all foraging habitat (pine trees greater than 10 inches diameter) to a basal area of 60 square feet and extensive regeneration over the last 30 years. Current stand conditions will essentially prohibit harvest of sawtimber size trees in these areas for the next 10-20 years.

The degree of impact will decrease with time as the stands currently in the 0-30 age classes grow older. This will again allow the harvest of sawtimber from the RCW HMAs, which will in turn increase revenues to a point greater than the cost of preparing sales (above cost).

(6) Would the proposed action and alternatives limit access to National Forest System lands for the purpose of oil and gas exploration and development?

Oil and natural gas are the most predominant leasable minerals on the 11 National Forests with RCW. Of these 11 forests, five have significant acreage under lease for oil and gas. Restrictions on activities within RCW clusters could limit access for exploration and development. The acres on which surface occupancy is prohibited and acres where they may occur in RCW HMAs are presented in Table 2-3.

Table 2-3
Area in RCW HMAs Where Oil and Gas Exploration is Affected, by Alternative.
The area where activities are restricted represent a small percentage of all National Forest acres.

Limitation	Area Affected (Thousand Acres) Alternatives				
	A	B	C	D	E
Surface Occupancy Prohibited	124.5	124.5	156.7	156.7	156.7
Allowed*	1390.0	**	1861.4	1861.4	1861.4

* Depending on proximity to active clusters, restrictions on timing of drilling activity to avoid nesting season may be required.

** Alternative B has no HMA other than clusters.

Recreation Issues

(7) Would the proposed action and alternatives affect use and construction of recreation facilities and trails?

Outdoor recreation is a significant use of the National Forests. Implementation of the proposed action or alternatives may affect the construction or use of recreation facilities, including off-road vehicle trails.

Alternative B would allow the construction of an off-road vehicle trail through a cluster if the construction activities take place outside the nesting season and if cavity trees are protected. Facilities with heavy concentrated human use, such as campgrounds, would be located outside clusters if possible.

Alternatives A, C, D, and E prohibit the construction of such facilities or trails within a cluster. However, if a RCW should excavate a cavity and move near an existing facility or trail, the facility or trail would not be affected unless monitoring indicates an adverse effect on the RCW. Such adverse effects are not likely. It may take months, even years, for a RCW to excavate a cavity and during this extended time, use of the facility/trail will surely have occurred.

(8) Would the proposed action and alternatives which allow southern pine beetle control in wilderness to protect RCW groups or their foraging habitat, affect wilderness attributes and use?

The control of southern pine beetles to protect RCW clusters or foraging habitat within wilderness involves the cutting of trees. Depending on the severity of the beetle outbreak, few or many acres of trees may be cut. Such cutting would change the appearance of the wilderness, affecting the quality of wilderness experience enjoyed by some visitors.

All alternatives recommend that RCW within wilderness be managed in accordance with appropriate guidelines (see FSM 2323.31b for direction on manipulation of wildlife habitat within wilderness). In addition, Alternatives A, C, D, and E recommend that RCW within wildernesses be drawn out of the area through development of recruitment stands with artificial cavities if an appropriate wilderness management plan is not developed and approved. This would allow more freedom in the future management of these RCW and result in no effects on the current appearance of the wilderness.

Alternatives A, B, C, and D would continue to allow southern pine beetle control per the Southern Pine Beetle Environmental Impact Statement and Record of Decision to protect RCW clusters and foraging habitat within designated wilderness.

Alternative E considers all wilderness RCW groups nonessential to recovery and would not control southern pine beetle to protect RCW groups within wilderness, but many take control actions within a wilderness to protect a group located outside the wilderness boundary.

(9) Would the proposed action and alternatives cause potential degradation to air quality?

The only activity to accomplish RCW management objectives which could degrade air quality is the prescribed burning needed to keep midstory under control. The potential effect on air quality is proportional to the acres being burned each year and the time of year the burning occurs.

Alternative A proposes the burning of approximately 363,000 acres annually. Emphasis is on growing season burns.

Alternative B requires the fewest acres be prescribed burned annually--approximately 32,000. Emphasis is on dormant season burns.

Alternatives C and D call for prescribed burning of approximately 490,000 acres annually. Emphasis is on growing season burns.

Alternative E burns the same acres as do Alternatives C and D. Growing season burning is emphasized. However, burning is likely to occur any time during the year when conditions are appropriate.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

The interdisciplinary team considered 10 alternatives during the analysis process. Five of these were eliminated from detailed study. The following is a brief description of and reasons for elimination for each:

(1) Preservation; Allow habitat to age; no silvicultural manipulation to replace RCW habitat as it is lost to mortality.

This alternative addresses the preservation approach to long-term RCW management. Habitat Management Areas would be delineated and population objectives set using the direction detailed in Appendix A. There would be no thinnings or regeneration cutting. Southern pine beetle control and hazard reduction thinnings would not occur. There would be no restoration of longleaf or shortleaf pine in areas currently occupied with off-site slash, loblolly, or sand pine except as it would occur naturally.

Replacement and recruitment stands would not be identified, and there would be no use of restrictors, translocation, artificial cavities, mechanical or chemical midstory control, or prescribed burning. Only natural forces would have impacts on habitat conditions. Wildfires within HMAs would be allowed to burn as long as fuel and weather conditions were such that control would be possible if needed.

Reason for elimination: This alternative was not developed in detail because of a lack of cluster management, midstory control, southern pine beetle control and hazard reduction, and lack of regeneration providing habitat through time would eventually lead to unfavorable habitat conditions for the RCW.

It is recognized that "natural" disturbances sustained RCW prior to arrival of European settlers. However, at that time many millions of acres of habitat existed. Today there are only a few million acres consisting of relatively small isolated islands of habitat, many of which are further fragmented by private inholdings. Therefore, natural fires are not likely to occur at the frequency, season, or scale as they occurred historically. Regular management of these areas is needed to ensure a constant flow of suitable RCW habitat through time. This alternative will not meet the objective of recovering the RCW, and through time, would eventually lead to declines in populations.

(2) RCW recovery efforts that include the birds' historic range.

This alternative would be identical to Alternative C except all inactive clusters would be included within an HMA and the scope would be expanded to include all areas known to have been occupied by RCW in 1970, the year the RCW was listed as an endangered species. This would include the Uwharrie, Tombigbee, and Sumter National Forests and the Caney District of the Kisatchie National Forest. The RCW has been extirpated from these areas and reintroduction of subadult pairs would be absolutely essential to successfully implement this alternative.

Reason for elimination: This alternative was not developed in detail for several reasons. None of the areas identified, the Uwharrie, Tombigbee, and Sumter National Forests and the Caney District of the Kisatchie National Forest, are tied to recovery populations identified in the RCW Recovery Plan (USDI Fish and Wildlife Service 1985). Reestablishing RCWs on these forests would be extremely expensive, both in terms of actual dollars spent and the number of young birds necessary to reintroduce a breeding population.

Also, three of the alternatives analyzed in detail include the analysis of historic range in the delineation of HMAs and the establishment of population objectives. These alternatives also allow the option to include areas currently unoccupied by RCW within HMAs (see Appendix A).

A major portion of the Forest Service's threatened and endangered species money would be required to create new RCW habitat and would significantly affect funds available for habitat management in currently occupied habitat and identified recovery populations. The budget to manage and recover other PETS species on National Forests is limited and must be portioned among the various plants and animals. The Forest Service must allow for management of many species, not just the RCW. The number of subadult birds required to reestablish breeding populations would seriously hamper current translocation efforts, adversely affecting existing RCW populations. Implementation of this alternative would delay recovery of the RCW by diverting badly needed resources, both funds and juvenile RCW, from the recovery populations and other populations which currently have RCW.

(3) Total uneven-aged management for the recovery of the RCW.

This alternative would be based upon the same guidelines that are in Alternative E. The major difference would be the lack of even-aged or two-aged silvicultural systems for regeneration of new RCW habitat. Clearcutting would not be allowed to convert off-site pine back to a more desirable pine species. There would not be clearcutting, shelterwood, or seed-tree regeneration employed for the purpose of habitat management. Uneven-aged regeneration methods employed would include group selection and single-tree selection. Southern pine beetle control efforts would continue.

Reason for elimination: There is much historic evidence supporting the theory that the pre-Colombian fire dependent pine forests that are home to the RCW were indeed uneven-aged forest. However, this same evidence also suggests the uneven-aged forest was made up of even-aged stands of various sizes (Wahlenberg 1946). The smaller even-aged groups may have been the result of a single, large, old tree falling. The other extreme, stands of hundreds or even thousands of acres, may have resulted from catastrophic events such as hurricanes or tornadoes.

The role of fire in the creation and maintenance of RCW habitat is also well documented (Wahlenberg 1946). The intensity of burning necessary to maintain quality RCW habitat is not compatible, in some cases, with uneven-aged management strategies, because the young pine trees needed to replace the older trees are killed by the fire. This is true of loblolly and shortleaf pines, which make up a significant component of RCW habitat.

At least one species of pine utilized by RCW, Virginia pine, is not compatible with uneven-aged management due to shallow-rootedness and proneness to windthrow (Carter and Snow 1990).

There are also thousands of acres of pine which currently occupy sites better suited to the native pine species which occurred there originally. From an ecosystem and RCW management standpoint, it is desirable to restore these native pine species. Uneven-aged management is generally not an acceptable system to restore these desirable pine species.

Uneven-aged management is analyzed in three of the alternatives which are considered in detail. Alternatives B, C and E allow the manager to select and use uneven-aged methods. Uneven-aged management and the situations in which it is acceptable are described on pages 64-67. The effects of implementing all silvicultural systems are addressed in Chapter 3 under the various environmental components/resources.

It became obvious early in the alternative development process that a total uneven-aged alternative would not meet the purpose and need of the proposed action, which is intended to recover the RCW. A variety of forest management options are necessary if the goal of recovery is to be achieved. Given that both Alternatives C and E allow uneven-aged silviculture, in addition to other silvicultural systems if needed, the total uneven-aged alternative was eliminated from further detailed analysis.

(4) Short rotation habitat management for RCW recovery

This alternative is tailored most to resemble an industrial forest management regime, one that grows large pulpwood or small sawtimber. This alternative would have been similar to the 1985 handbook direction and would have utilized rotation ages of 40-50 years. These shorter rotations would be applied across all RCW Habitat Management Areas. Future cavity trees would be provided by identifying and protecting recruitment stands. Only even-aged silviculture would be utilized in the recovery of the RCW.

Reason for elimination: The development of suitable cavity trees usually takes anywhere from 60 to 100 years, depending on the pine species. This alternative would eliminate all pines in the general forest area before any become old enough to be potential cavity trees. Such short rotations would also harvest the trees before they become large enough to accept cavity inserts. Such short rotations would also fragment foraging habitat because of the large percentage of habitat which could be harvested each decade. Given that the recruitment stand strategy to provide future nesting habitat, without use of artificial cavities, has been unsuccessful and such short rotations will allow for no future cavity trees in the general forest area, this alternative will not meet the objective of recovering the RCW.

(5) Texas Comprehensive Court-Ordered Management Plan.

This alternative is the plan developed by the National Forests in Texas to comply with the District Courts order in Sierra Club vs. Lyng (now Sierra Club vs. Glickman). It places 1200-meter radius circles around clusters as management areas. Within these circles an untested uneven-aged management strategy is applied. It depends on thinning to a basal area of 60, with at least 40 basal area of the 60 always being the oldest available trees. This alternative would use only thinnings of RCW habitat to a basal area of 60. Each time the basal area increased to 90, the stands would again be thinned back to 60 basal area, protecting the oldest trees. Slash pine stands that are located on historic longleaf sites could be converted back to longleaf pine using the clearcut method.

Reason for elimination: The USDI Fish and Wildlife Service, in its biological opinion on the Texas Comprehensive Plan, states the court-ordered plan is likely to jeopardize the continued existence of the RCW. The opinion states:

> "With an unproven forest management system such as the one proposed, no one can be absolutely sure about the success or failure of the system. The inflexible criteria of always leaving 40 basal area of the oldest trees in the thinning regime will, in all probability, result in a deficit in certain age classes of trees. Some management zones are expected to already be adequately stocked with older aged trees for the next 10 to 15 years. In those zones where there are sufficient numbers of old trees that are actually surplus to the RCW's needs, management flexibility is needed in order to prescribe retention of trees younger than the oldest trees present in the 40 basal area component. Without that management flexibility, some management zones would, in 50 to 120 years, be overstocked with very old trees, but understocked with younger trees that are needed to replace the oldest trees that are lost through natural mortality from the management zone. Under that circumstance, there would eventually be a period of time during which there would be an insufficient number of suitable cavity trees in the particular 1200-meter management zone. The absolute thinning criteria would most certainly restrict the ability of managers to insure the continuous supply of adequate foraging and nesting habitats that is needed in the long term to maintain the RCW."

(USDI, Fish and Wildlife Service biological opinion of the Dec. 15, 1988, Texas Comprehensive Court Ordered Management Plan on the Red-Cockaded Woodpecker, signed by Michael Spear, Regional Director).

The 1200-meter management areas in many cases (where there are widely scattered clusters) will not provide the large contiguous blocks of habitat needed to support adequately dispersed populations large enough to achieve recovery.

Based upon the court-ordered plan's failure to insure a continuous supply of habitat and its failure to meet the demographic needs of the RCW, it will not meet the objective of recovering the RCW.

COMPARISON OF ALTERNATIVES

Table 2-4 is a summarized comparison of the five alternatives analyzed in detail. It is not a detailed description of the alternatives, but is intended to allow the reader to evaluate the major differences. A detailed description of the alternatives follow the table.

Table 2-4. Comparison of Alternatives by Specific Management Activities.

Specific Activities	Alternative A (No Action)	Alternative B	Alternative C	Alternative D	Alternative E (Proposed Action)
I. Habitat Management Area (HMA) Designated	No, management areas are 3/4-mile radius circles around active and inactive clusters	No, only clusters, recruitment and replacement stands are managed specifically for RCW.	Yes, habitat management areas are contiguous blocks of habitat with a 6,150 ac. minimum size. See appendix A for detail discussion	Same as Alternative C	Same as Alternative C
A. Setting Population Objective	Yes, will comply with population objectives in the 1985 Handbook	Yes, similar to Alternative A, but modified to comply with FWS RCW Recovery Plan.	Yes, per the process described in Appendix A. A min. of 250 breeding pair in recovery populations and minimum of 25 breeding pair in support populations	Same as Alternative C	Same as Alternative C
B. Establishment of Sub-HMAs	No	No	No	No	Yes
C. Management Intensity Levels (MIL) Designated	No, however, the 3/4-mile radius circles are broken down into two zones which receive different levels of management	No	Yes, 5 MIL are identified	Same as Alternative C	Yes, 4 MIL are identified
II. Cluster Site, Replacement and Recruitment Stand:					
A. Protection					
1. Cutting	Cutting/killing trees will not occur except for limited exceptions	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
2. Motorized/Heavy Equipment Use, Concentrated Human Use	Limited/restricted depending on time of activity	Similar to Alternative A, degree of restriction based on RCW population size	Same as Alternative A	Same as Alternative A	Same as Alternative A
3. Prescribed Burning	Protect Cavity Trees, no plow lines in Cluster	Same as Alternative A but no restriction on plow line location	Same as Alternative A	Same as Alternative A	Similar to Alternative A, keep plow line 200' from cavity trees
4. Nesting Season Disturbance	Prohibited in active clusters	Similar to Alternative A, restriction based on RCW population size	Same as Alternative A, prescribed burning allowed	Same as Alternative C	Same as Alternative C

Table 2-4. Comparison of Alternatives by Specific Management Activities.

Specific Activities	Alternative A (NoAction)	Alternative B	Alternative C	Alternative D	Alternative E (Proposed Action)
5. Construction of Rights-of-way	Prohibited	Allowed outside of nesting season	Same as Alternative A	Same as Alternative A	Same as Alternative A
6. Existing Rights-of-way	Reconstruction or maintenance may occur if detailed analysis indicates no adverse effects on RCW. Any work done will be outside nesting season.	Allowed	Same as Alternative A	Same as Alternative A	Similar to Alternative A, light maintenance allowed during nesting season
7. Southern Pine Beetle Management	Follow direction in SPB Record of Decision and FEIS with site specific NEPA/ESA Compliance	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A, except no SPB control to protect wilderness RCW clusters
B. Management					
1. Monumentation	Map all clusters. Mark all cavity trees and delineate 200-ft. buffer around aggregate of cavity trees. Monumentation must be updated before planned habitat alteration within 1/4-mile zones.	Mark all cavity trees, map clusters, and delineate 200-ft. buffer around aggregate of cavity trees	Same as Alternative A	Same as Alternative A	Similar to Alternative A, marking of cluster boundaries necessary only when certain activities to occur within 1/4 mi. of cluster.
2. Establishing Replacement/ Recruitment Stands	Required	Same as Alternative A	Similar to Alternative A, requirements vary by MIL	Same as Alternative C	Similar to Alternative C, but only 4 MIL identified
3. Mid-story Removal/Control	Mandatory in cluster sites, Recruitment and Replacement stands. Encouraged in remaining pine type within 3/4-mi. circles	Mandatory in cluster sites, Recruitment and Replacement stands	Same as Alternative A	Same as Alternative A	Similar to Alternative A, some desirable midstory trees can remain in clusters
4. Cavity Restrictors	Required , objective is 4 usable cavities per cluster	Same as Alternative A	Same as Alternative A in MIL 5-2, optional in MIL 1	Same as Alternative C	Same as Alternative A in MIL 4-2, optional in MIL 1
5. Translocation	Required as needed	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
6. Artificial Cavities	Encouraged as needed	Same as Alternative A	Required as needed in MIL 5-2, optional in MIL 1	Same as Alternative C	Required as needed in MIL 4-2, optional in MIL 1

Table 2-4. Comparison of Alternatives by Specific Management Activities.

Specific Activities	Alternative A (NoAction)	Alternative B	Alternative C	Alternative D	Alternative E (Proposed Action)
III. Habitat Management The following activities apply to areas outside cluster sites, recruitment and replacement stands.					
A. Prescribed Burning	Yes, entire 3/4-mile circle on 2-5 year cycle, growing season burns encouraged.	Emphasized only in clusters, replacement and recruitment stands. Not required in foraging habitat.	Same as Alternative A, except entire HMA.	Same as Alternative A	Similar to Alternative A, but recognizes need to burn any season as needed
B. Pine Restoration	Encouraged with restrictions to prevent habitat fragmentation, longleaf pine only.	Similar to Alternative A, but restoration of other pine species allowed.	Similar to Alternative B, with restrictions to prevent habitat fragmentation.	Same as Alternative C	Similar to Alternative C, area control by forest management type allowed
C. Foraging Habitat	≥ 8,490 square feet pine basal area. ≥ 6350 pine stems. ≥ 10" DBH & > 30 years old.	Same as Alternative A	Same as Alternative A, plus provision to provide foraging for non-FS RCW	Same as Alternative C	Same as Alternative C.
D. Future Nesting Habitat Management	Yes, utilizing thinnings to enhance development and no regeneration cutting in the oldest 1/3 of pine acres until within 10-20 years of rotation age, through the first rotation.	Not required outside clusters	Same as Alternative A	Same as Alternative A	Same as Alternative A
E. Habitat Mgmt. Criteria					
1. Rotation	120-Year rotation on all pine species used by RCW is implied.	80 years longleaf and 70 years for other yellow pines with recruitment and replacement stands. Without R/R stands, 100 and 80 years.	Varies by site quality. longleaf and shortleaf: 100-200 yrs. Loblolly and slash: 80-120 years. Virginia pine: 60-80 years.	No rotation or planned regeneration	Virginia pine: 70 years. loblolly & slash pine: 100 years. Longleaf & shortleaf: 120 years. Loblolly/shortleaf in high SPB risk areas: 80 years.
2. Thinning	Encouraged, if foraging is available. Leave tree priorities: 1. relict tree 2. potential cavity trees 3. trees ≥ 10" DBH 4. trees ≤ 10" DBH	Similar to Alternative A, standard silviculture guidelines used to select leave trees	Same as Alternative A	Yes, on limited basis	Same as Alternative A, with exceptions to allow thinning if foraging is limited in overly dense mature pine stands.

Table 2-4. Comparison of Alternatives by Specific Management Activities.

Specific Activities	Alternative A (No Action)	Alternative B	Alternative C	Alternative D	Alternative E (Proposed Action)
3. Regeneration					
a. Clearcut*	To be considered only for pine restorations, to regenerate wet slash pine sites, and damaged or sparse stands	Clearcutting of suitable habitat may occur if site-specific analysis determines adequate foraging is maintained and not isolated from cluster	Same as Alternative A, plus regeneration of Virginia and pitch pine	Only used to restore desirable pine species	Similar to Alternative C, but wet site slash pine regeneration is not allowed
b. Standard Shelterwood/Seed-tree	Not allowed	Allowed	Allowed only in MIL I and MIL II	Not allowed, no planned regeneration	Allowed in MIL I
c. Irregular Shelterwood	Allowed between 1/4 & 3/4 mile of clusters	Allowed	Allowed, mitigation varies by MIL	Not allowed, no planned regeneration	Similar to Alternative C, but different mitigation
d. Group Selection Methods	Not allowed	Allowed, per Forest Plans	Allowed	Not allowed, no planned timber harvest	Allowed
e. Single-tree Selection	Not allowed	Allowed, per Forest Plans	Allowed	Not allowed, no planned timber harvest	Allowed
4. Fragmentation Control	Yes	Yes, but limited	Yes	Yes	Yes
5. SPB Hazard Reduction	Yes , per SPB FEIS	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
6. Clearing for Non-timber Purposes	Allowed with restrictions which vary by distance from clusters	Allowed if site-specific analysis indicate RCW is not likely to be adversely affected	Similar to Alternative A, but restrictions vary by MIL	Same as Alternative C	Same as Alternative C
7. Monitoring	Mandatory	Mandatory	Mandatory intensity varies by MIL	Same as Alternative C	Mandatory, intensity varies by population size and trend (not MIL)

*The Use of clearcutting has been limited in all alternatives to conform with the Chief's 1130-1 letter dated June 4, 1992 and with the NFMA at 16 U.S.C. 164 (g) (3) (F) (i). In keeping with this direction the amount of clearcutting will not vary significantly among the alternatives.

ACTIVITIES COMMON TO THREE OR MORE ALTERNATIVES

The intent of all alternatives is the protection of the RCW and improvement of its habitat. Therefore, many management activities are common to three or more alternatives. To avoid repetition, the following section describes these common activities and identifies the alternatives in which they occur.

The individual alternative descriptions will identify when, where and to what extent the activities will be used, as well as any specific deviations from the general descriptions.

Habitat Management Areas

Alternatives C, D, and E establish Habitat Management Areas (HMAs) utilizing the process detailed in Appendix A. The red-cockaded woodpecker requires relatively large contiguous blocks of suitable habitat to ensure proper spatial arrangement of RCW groups within the population. Such spatial arrangement is important to population viability (Walters 1990, Walters et al. 1988b, Walters et al. unpublished).

The HMA encompasses an area suitable for RCW management and provides the basis for achieving the desired future condition: sufficient habitat to meet population objectives and recover the RCW. Isolated subpopulations are delineated to show the current situation. Large HMAs provide connected habitat for isolated subpopulations. Expansion of subpopulations into this habitat will result in one large, contiguous RCW population. The HMA is the area allocated to RCW management and may become a management area, or set of management areas, in the Forest Plan. HMAs are not simply management units where RCW may be found, but a long-term commitment to RCW management with relatively inflexible boundaries.

The Forest Service proposes to establish HMAs of sufficient size to support at least 50 RCW groups for support populations (10,000- to 15,000-acre minimum) and generally 500 or more groups for recovery populations (100,000 to 150,000 acres), if the available land base will allow. The tentative HMA size, current and tentative population objectives for Alternatives C, D, and E are shown in Table S-1.

Management Intensity Levels

Alternatives C, D, and E incorporate a risk classification strategy. This strategy would classify RCW populations by risk of extirpation (local extinction) and manage each risk category differently. Small widely dispersed RCW populations need more protection and different management than larger populations of more closely spaced groups (Conner and Rudolph 1991a).

Management intensity levels would be the basis for designing specific management strategies to recover the RCW in different areas by varying the level of management and protection to the survival needs of individual populations. This is somewhat similar to the way a hospital manages its patients according to the severity of their illness or injury: emergency, intensive care, general care, and outpatient services.

Alternatives C and D establish five different MILs, while Alternative E would establish four different MILs, all based on the risk of extirpation faced by the RCW in each HMA or subpopulation within an HMA. In all three alternatives, MIL 1 (a population having reached its population objective) represents the same size population. Management intensity level 5 in Alternatives C and D and MIL 4 in Alternative E also represent the same population levels (the smallest most vulnerable populations).

The risk of extirpation is determined by the average number of RCW groups within a population fledging young annually (reproducing population) and whether the population has a decreasing, stable, or increasing population trend.

The determination of reproducing population size requires population-specific reproductive data, collected through monitoring. If this data is not available, MIL classification can be determined using the number of potentially breeding pairs or the total number of active clusters.

Two sets of MIL classification criteria were developed: one set for populations with a land base large enough to support 500 groups and another set for populations with inadequate acreage to support 500 groups. Tables showing the MIL breakdown for these two situations are shown in the respective alternative descriptions.

The reproducing population, rather than total number of active clusters should determine MIL. For example, for a population to move into MIL 1 and be declared recovered, it must have a reproducing population greater than 250 and a population trend of stable or increasing. However, if reproductive data is inadequate to determine the reproducing population, the population must have 400 or more potentially breeding pairs or 500 total active clusters to be declared recovered. Conversely, if reproductive data shows a reproducing population has been reached, of greater than 250, even though the total population is only 400 active clusters, it would also be classified as MIL 1.

The Forest Service would monitor and reassess MIL classifications of all RCW populations annually, based on how the population has performed the previous five years. The MIL can be adjusted up or down depending on whether the population is increasing or decreasing based on a five-year running average, that is, a population must show an increase over five years before it can move into the next MIL. This will avoid the risk of reducing management and protection intensities prematurely due to minor or short-term annual population fluctuations.

When RCW populations are increasing, the MIL tables in the respective alternatives will be used. However, the tables do not work equally well when populations are declining. Therefore, any population loss greater than 10 percent over a five year period, or less, will trigger an increase in MIL as well as initiation of consultation with the Fish and Wildlife Service.

In populations with inadequate acreage, at least 50 percent of the total active clusters must be fledging young annually in order to move into a less restrictive MIL. For example: A severe risk (MIL 3) population with a reproducing population of 120 groups that was previously declining, is stabilized and increases steadily by 10 over the five-year period would be reassigned as moderate risk (MIL 2). The HMA would then be managed under MIL 2 guidelines.

The Forest Service recognizes the importance of artificial cavities and translocation of RCW in recovery of the species, and these activities will be used extensively. However, the Forest Service's long-term goal is the production of suitable RCW habitat through an ecosystem management approach, in which the species can sustain itself without these practices. Therefore, RCW populations approaching recovery or HMA population objectives will be evaluated to determine whether they are capable of sustaining themselves without the use of artificial cavities or translocation.

In order to move into MIL 1 (recovered or having achieved the HMA population objective) a population must maintain a stable or increasing population for at least five years without additional artificial cavities or translocation. It is recognized that some RCW populations, due to the young age of existing stands, may be dependent on artificial cavities for 20 to 40 years. Periodic translocation to maintain genetic viability in populations with limited land base and emergency use of artificial cavities resulting from catastrophic events would be allowed.

Populations will not be reclassified as MIL 1 unless at least 75 percent or more of the historic RCW population range on the National Forest, as described and delineated in Appendix A, has been included within the HMA(s). Otherwise, the population would remain classified as MIL 2, regardless of population.

In HMAs with more than one demographic subpopulation of RCW, the MIL for the entire HMA would be based on the subpopulation with the highest risk of extirpation.

Some forests may choose to establish HMAs in areas where no RCW currently occur. Given the need to recover existing populations, it will in all probability be decades before enough RCW will be available to attempt reintroductions into these areas. Therefore, such HMAs will be managed as if they had an RCW population of MIL 2. Regeneration could continue to occur based on new rotations and an average of six trees per acre would be left in regeneration areas.

Tables describing the different MILs and summarizing management practices associated with each are found in the respective alternative descriptions.

Clusters, Replacement, and Recruitment Stands

All alternatives include the establishment of clusters, replacement, and recruitment stands.

A cluster is an aggregate of active and/or inactive cavity trees within 1500 feet of each other as defined by Harlow et al. 1983. The boundary around active and inactive clusters must be at least 200 feet from all cavity trees. The cluster should be identified as a stand not less than 10 acres in size. A cluster is classified as active if RCW are present.

Recruitment stands are stands of pine trees 10 acres or larger containing older trees. They are located between 1/4 and 3/4 mile from an active cluster or another recruitment stand. They provide potential nesting habitat for the RCW population to expand into forming new active clusters. They may or may not contain artificial cavities depending on distance to the nearest active cluster.

Replacement stands are stands of pine trees located adjacent to or very close to active clusters. Preferably they should be 20 to 30 years younger than the nearby cavity trees. Their function is to replace existing cluster sites as they age and become unsuitable for RCW nesting.

The clusters, recruitment stands, and replacement stands are intended to provide sustainable RCW nesting habitat, rather than for multiple use. There is no set rotation age, and activities that would disturb the RCW are limited. The boundaries could change as new cavities are excavated or artificial cavities are installed. These stands would remain until they age and can no longer provide suitable nesting habitat.

Clusters, recruitment stands and replacement stands should be open, park like stands of mature pines with a basal area ranging from 60 to 80 square feet. The trees should be spaced at least 20 to 25 feet apart to reduce the risk of attack by southern pine beetle. For stands with an average tree diameter greater than 14 inches, the 60 to 80 basal area guideline would ensure adequate spacing.

Midstory Vegetation Control

All alternatives would require midstory removal and control be completed in all clusters, recruitment stands and replacement stands outside of wildernesses and should be completed for all wilderness groups. RCWs typically abandon their nests when adjacent midstory trees grow taller than the cavity.

Prescribed burning is generally the best way to control midstory vegetation, especially small hardwoods. The RCW prefers an open park-like forest which can be maintained by underburning every two to five years after the new age class of pine trees reaches a fire-resistant stage.

Fire cannot control larger midstory hardwoods (greater than two inches in diameter). Hardwood trees are common in pine stands where fire has been excluded for many years or where dormant season burns have been ineffective.

These larger trees may be eliminated by:

- Mechanical methods using a feller-buncher, hydro-ax, mulcher, shearing blade, etc.
- Manual methods using a chainsaw, brush hooks, etc.
- Herbicides applied by injection, hypo-hatchet, handsprayer, etc.

Or a combination of these methods.

Variations in area to be treated and timing of prescribed burning are described in the individual alternative descriptions.

Artificial Cavities

Artificial cavities will play a key role in recovery of the RCW. One of the major limiting factors for RCW is the lack of trees old enough for the birds to excavate natural cavities. Artificial cavities will be used to stabilize existing active clusters where usable cavities are limiting. Use of artificial cavities in active clusters should increase fecundity and fledling-to-helper transition (Heppell et al. 1994). They will also play an important part in expanding populations, as their use in conjunction with recruitment stands has been shown to stimulate colonization of currently unoccupied habitat (Copeyon et al. 1991, Gaines et al. 1995, Heppell et al. 1994, Richardson and Stockie 1995, Reinman 1995). Given the limited number of existing potential natural cavity trees, artificial cavities will be necessary to achieve substantial population expansion over the next 20-40 years.

All alternatives will establish criteria and priorities for installing artificial cavities in all RCW populations where suitable cavity trees are limited (less than four functional cavities per cluster). The Forest Service will install three types of artificial cavities depending on the characteristics of the trees present and the needs of the particular group of RCWs. All three types of artificial cavities have proven very effective on the Francis Marion National Forest after Hurricane Hugo (Allen 1991, Taylor and Hooper 1991, Watson et al. 1995).

- **Drilled cavities.**

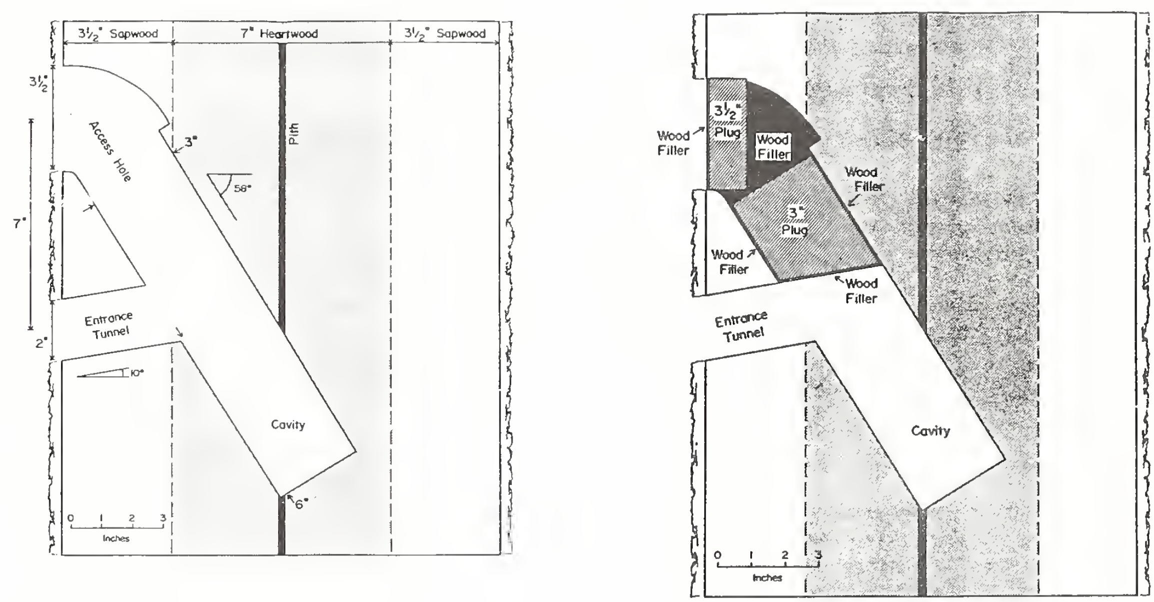
  As their name implies, drilled cavities are literally cavities drilled into a living pine tree with a drill. Carole K. Copeyon, while a graduate student working with Dr. Jeffrey Walters in the Department of Zoology at North Carolina State University, invented a successful technique for drilled artificial cavities (Copeyon 1990). A modification of Copeyon's method (Taylor and Hooper 1991) will be used. They require at least 7 inches of heartwood and no more than 3.5 inches of sapwood at cavity height to implement successfully. The presence of heartwood is necessary to prevent resin from collecting in the cavity and trapping any RCW which may attempt to use it. Drilled cavities provide a complete cavity. Monitoring evidence suggests three possible advantages over cavity inserts:

  (1) Host tree has better wind resistance due to less structural damage to the tree during installation.

  (2) It is less likely to be enlarged by other animals, which would make it useless for the RCW.

  (3) It may be occupied sooner because it appears more like a natural RCW cavity.

Figure 2-1
Drilled Artificial Cavities
The following series of drawings illustrate how these cavities are constructed:



- **Drilled start-holes.**

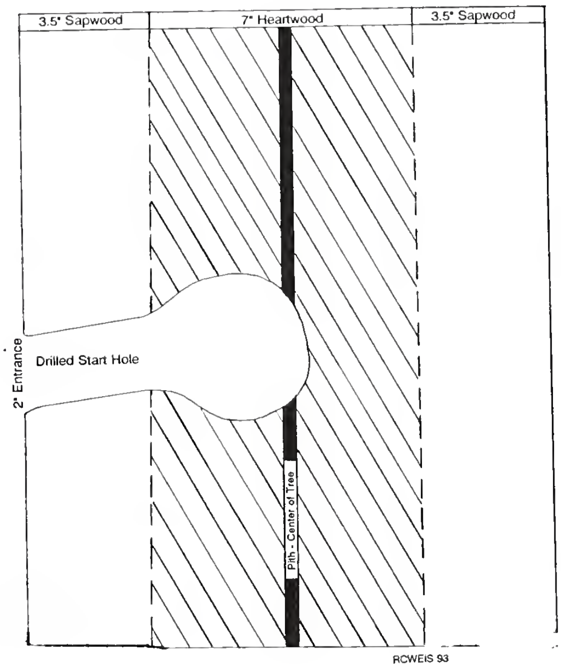
  Drilled start-holes are simply the drilling of the entrance tunnel as you would for a drilled cavity (Copeyon 1990). A small cavity is created at the end by wiggling the drill bit around once the tunnel is drilled to the appropriate depth. They require at least six inches of heartwood. Drilled start-holes are recommended where cavities are not critically limited or in addition to complete cavities. They are readily completed into usable cavities by the RCW and are sometime used as roost cavities soon after construction. They offer three advantages over complete cavity construction:

  (1) Become nearly identical to natural cavities when completed by the RCW.

  (2) Do the least damage to the host tree and may be less susceptible to southern pine beetle attacks and wind damage.

  (3) Easier, faster, and less expensive.

Figure 2-2
A Drilled Start Hole
Figure 2-2 shows how a drilled start hole is constructed and what a finished hole looks like.



- **Cavity inserts.**

  Cavity inserts are very different from the two varieties of drilled cavities. They do not require heartwood, but must be installed in pine trees more than 15 inches in diameter at cavity height to ensure structural integrity.

  The insert resembles a typical bluebird box. It is constructed from a solid block of wood, usually western red cedar, by drilling two holes, one to create the cavity and the second to create the entrance tunnel. The insert is then "inserted" into a hole cut into a living pine tree with a chainsaw. Figure 2-3 shows an insert and how it is installed.

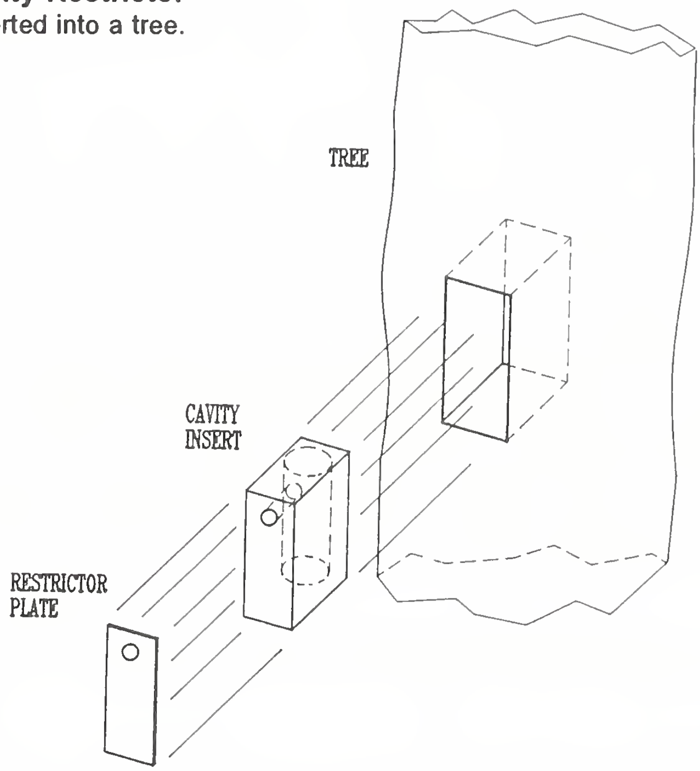
  Cavity inserts provide a complete cavity and have three advantages over drilled cavities.

  (1) Can be used in younger trees which are large enough but lacking sufficient heartwood.

  (2) Less potential problem with sap running into cavity.

  (3) Easier and lower cost to install.

Figure 2-3
A Cavity Insert with Cavity Restrictor
An insert is a birdhouse inserted into a tree.



With all three types of artificial cavities, the final step of installation is treating the tree to give it a "natural cavity" appearance. This is accomplished by creating resin wells around the newly constructed cavity. These are small holes cut into the tree with a wood chisel, to start the flow of resin. Paint and wood filler are used to mimic the off-white dried resin on established cavity trees. This cosmetic treatment reduces the time it takes RCW to find and start using the cavity.

Installation of artificial cavities requires monitoring to ensure proper installation and acceptance by RCW.

Reducing Cavity Competition

Cavity restrictors are metal plates with an oblong hole large enough for the RCW (generally 1-3/4" by 2-3/4") as shown in **Figure 2-3**. Cavity restrictors are placed around cavity entrances to prevent other birds (especially pileated and red-bellied woodpeckers) and mammals from enlarging them and displacing the RCW (Carter et al. 1989). To ensure negative effects do not occur, monitoring is required after installation of restrictors. If individuals do not accept the restricted cavity or can't fit into the entrance hole, restrictors should be removed, repositioned, or the entrance hole in the restrictor should be enlarged. To prevent RCW from being trapped and killed, care should be taken during installation to ensure any gaps which could trap a RCW are hammered flat against the tree. Intensive monitoring should continue. Limited cavity availability in some areas has adversely affected the RCW. Cavity competition can be minimized by the following:

- Ensure that each group has at least four functional cavities through use of restrictors and/or artificial cavities.

- Within 1/2 mile of active RCW clusters and inactive clusters or recruitment stands that have been made suitable for augmentation, retain uninfested/SPB vacated single dead trees. Within 1/4 mile of inactive RCW clusters which are not suitable for augmentation, retain uninfested/SPB vacated single dead trees. In SPB spots one acre or larger in size, retain a minimum of six vacated sawtimber trees per acre, if available, two of which should be the larger vacated trees. In SPB spots less than one acre, retain a minimum of two larger vacated sawtimber trees, if available. Preliminary research suggests presence of snags with cavities in and near clusters may reduce competition for RCW cavities (Kappes 1994). This does not preclude salvage of dead trees from large areas resulting from insect outbreaks, hurricanes, tornadoes, or other catastrophic occurrences.

- Maintain adequate levels of midstory control. This creates an unsuitable habitat condition for some cavity competitors.

- Install squirrel and non-lethal snake excluder devices as needed (Neal et al. 1993, Montague and Neal 1995, Withgott et al. 1995).

Cavity restrictors should be placed on enlarged RCW cavities and on unenlarged cavities where experience shows cavity enlargement is likely. The highest priority is active clusters which have a single cavity tree followed by single-bird groups, then those clusters with 2 to 4 suitable cavities, and 5 to 8 cavities.

All insert type artificial cavities should be fitted with restrictors when installed. Restrictors will be put on drilled cavities or starts only if experience shows cavity enlargement is likely.

Restrictors should not be used on cavities which have been enlarged internally to the point of being unusable by RCW.

The Forest Service will monitor cavity restrictors to ensure proper installation and acceptance by the RCW.

Translocation

The Forest Service has successfully moved (translocated) RCW from one location to another to help form breeding pairs and increase populations. Translocation of RCW, like artificial cavities, will play a key role in population expansion and eventual recovery. Current technology will only allow the translocation of juvenile birds. Adult RCW are extremely territorial and if moved will generally attempt to return to their home cluster, no matter how far away. Therefore, adults should not be moved unless special circumstances exist and the Fish and Wildlife Service approves the move.

There are two types of translocation. The most frequently used type is also referred to as augmentation. It is the moving of an appropriate sex juvenile RCW to a single-bird group, thus augmenting that group. Occasionally multiple bird groups which are all the same sex are augmented as well. Prior to augmentation attempts, a suitable cavity (natural or artificial) must be available in the cluster being augmented. Midstory control work should also be completed in advance.

The second type of translocation is the establishment of "new" RCW groups by releasing a nonrelated juvenile male and female together at properly prepared recruitment stands. This method of translocation has experienced some success (Rudolph, et al. 1992). The development of this translocation technique is important as it now offers the RCW manager the option of reintroducing RCW into areas where it has been extirpated. This method requires the availability of a fully functional recruitment stand, complete with cavities (natural or artificial) and appropriate midstory control.

When reintroductions are planned using this technique, it is desirable to create several groups (3-5, demographically linked) at the same time to increase the probability of successfully creating a new subpopulation.

Translocation serves both short- and long-term goals:

- It quickly increases the number of breeding pairs which helps small isolated subpopulations grow more rapidly than they could otherwise,

- It can be used to reestablish RCW into areas where they have been extirpated,

- It can be used to maintain genetic viability in populations below a reproducing population size of 250.

The translocation of RCW within populations/subpopulations is encouraged. The short distances birds must be moved and the frequent similarity of the habitat may increase the probability of successful pairings. If translocations between populations are necessary, it is desirable to move birds between areas that are of similar latitude, elevation, and forest type.

The planned translocation of RCW will be required to maintain the genetic viability of populations with a reproducing population of less than 250. The effectiveness of such translocations will depend on the number of RCW moved to a specific population and the genetic makeup of these birds in relation to the receiving population. Such genetic exchanges can be through normal subadult augmentation.

THE FOLLOWING ACTIVITIES MAY OCCUR IN AREAS WITHIN AN HMA, BUT OUTSIDE CLUSTERS, REPLACEMENT, AND RECRUITMENT STANDS.

Prescribed Burning

Fire is an important ecological factor in the establishment, growth, and development of southern pines. Fire can destroy pine trees as well as ensure their survival. The pine species are affected by fire differently at certain stages of development. Each pine species needs a certain fire-free period in order to survive, grow, and develop. Longleaf seedlings, from the time they start height growth up to 2-3 feet in height are susceptable to fire damage. Loblolly, shortleaf and slash pine are susceptable to fire until they reach 10-15 feet in height. The time needed to grow out of fire susceptability varies by site.

The open structure of the pine forest preferred by the RCW was historically maintained by periodic fires. Over much of the RCW's range these fires occurred during the growing season (spring and summer), although naturally occurring fires did occur at all times of the year. Continued use of fire, through an intensive prescribed burning program, is critical to the survival and recovery of the RCW.

All alternatives would establish a prescribed burning cycle of two to five years to aid in control of midstory vegetation within clusters, replacement, and recruitment stands. Outside these areas, all alternatives except B will use prescribed burning to reduce midstory vegetation and fire hazard. The objective here **is not** the total removal of midstory, but a reduction using prescribed fire as a management tool. The Forest Service will use natural firebreaks (streams, swamps, lakes, etc.) wherever possible to reduce the impact from constructing firelines.

The specific prescription for burning in any area would be based on site specific evaluation, which would consider vegetation, site and weather conditions, and the RCW management priorities.

Variations in the season of burn and acres to be burned are described in the individual alternative descriptions.

Pine Restoration

Longleaf pine historically has provided much of the RCW's habitat. Over large areas, this tree species has been replaced by other pine species such as loblolly, slash, and sand pines. Other pine species which occurred naturally across the range of the RCW, loblolly, shortleaf, etc., have also been replaced by other pine species. For the purpose of this discussion, "off site" is defined as any pine growing on a site which was historically occupied by a different species, regardless of how well or poorly the off site species is growing.

Although pine restoration would be based on soil and site conditions and could be used to restore any desirable pine species, longleaf and shortleaf pines are likely to be the species restored most frequently. All alternatives encourage/allow restoration of the longer lived and more suitable pine types, unless the stand in question is needed to provide foraging or nesting habitat for the RCW in the immediate future. Conversely, conversion of longleaf pine, in areas occupied by RCW, to another pine species will normally not occur, but if necessary would require consultation with the Fish and Wildlife Service.

All alternatives would require a site-specific analysis for all pine restoration projects. The analysis must show pine restoration would have no short-term impacts and a long-term benefit to the RCW. Clearcutting will be the optimal method for restoring these species because it is the most efficient regeneration method to accomplish the objective. However, specific site conditions such as limited foraging habitat could require use of a different regeneration method, i.e., irregular shelterwood. The Forest Service recognizes the use of regeneration methods other than clearcutting to restore desirable pine species will result in increased time and cost.

Foraging Habitat Management

Specific acres are not permanently designated as foraging habitat. The present age class distributions, pine stand stocking levels, and RCW population densities usually determine the acres of suitable foraging habitat available around each cluster.

All alternatives will provide foraging habitat based on the number of pine trees required in the Blue Book issued by the Fish and Wildlife Service in 1989. There are some situations for a given alternative where foraging habitat may be reduced below the requirements established by the Fish and Wildlife Service.

Foraging habitat equivalents required by the Fish and Wildlife Service for each cluster and recruitment stand are:

- At least 8,490 square feet basal area in pine stems larger than 5 inches.
- At least 6,350 pine stems 10 inches in diameter or larger and 30 years old or older.
- Must be within 1/2 mile of the geometric center of the cluster.
- Must be continuous and contiguous with the cluster.
- Include only pine and pine-hardwood stands (excluding white and sand pine).

Available foraging habitat should include clusters, recruitment, and replacement stands, and contiguous suitable areas within 1/2 mile of active clusters or recruitment stands. Shelterwood cuts with 30-square-feet basal area of pine or greater can be considered suitable foraging habitat. If existing foraging habitat is inadequate, stands must be identified beyond 1/2 mile to provide the additional foraging habitat needed.

The Forest Service must ensure that adequate foraging habitat is available within 1/2 mile of clusters and recruitment stands after any harvest.

The foraging criteria are based on three studies conducted on the Francis Marion National Forest in South Carolina. The results are described in detail in the RCW Recovery Plan (USDI Fish and Wildlife Service 1985). The requirement for 6350 stems is based on reproductive output increasing as number of available pine stems increase up to 6350. This guideline was adopted in the RCW Recovery Plan to enhance recovery of populations. It does not represent the minimum amount of foraging necessary for a RCW group to function normally (Hooper and Lennartz 1995). There are studies which suggest **moderate to high density** RCW populations can function on less than the 6350 stems required by the recovery plan (Wood et al. 1985a, Wood et al. 1985b, Conner and Rudolph 1991b, Hooper and Lennartz 1995). A recent study by Beyer et al. (in preparation) found little or no correlation between reproductive success and foraging availability on the Apalachicola National Forest.

The required 6350 stems are based on the average foraging needs of a single RCW population and may not reflect the needs of different populations living in different areas and types of habitat. Therefore, Forests that have or in the future plan to complete area/population specific foraging requirement studies are encouraged to pursue such efforts in consultation with the Fish and Wildlife Service. Establishment of new foraging requirements for specific area/populations can occur only with concurrence from the Fish and Wildlife Service.

Variations in requirements for residual basal area and foraging habitat management criteria are described in individual alternative descriptions.

Table 2-5 shows the relationship of trees by diameter class and number of foraging acres needed. If all stands averaged 16 inches in diameter and stand basal area averaged 60 square feet per acre, for example, then about 148 acres would be needed as foraging. If all stands averaged 16 inches in diameter and stand basal area averaged 100 square feet per acre, then about 88 acres would be needed as foraging.

Table 2-5
Comparison of number of acres by diameter class and basal area per acre needed to provide foraging habitat requirements of 6350 pine stems ≥10 inches in diameter.

	Basal Area (square feet)							
	40		60		80		100	
DBH (inches)	Trees per acre	Acres	Trees per acre	Acres	Trees per acre	Acres	Trees per acre	Acres
10	73	87	111	57	147	43	183	35
12	51	125	76	84	102	62	127	50
14	37	172	56	114	75	85	94	68
16	29	219	43	148	57	112	72	88
18	23	276	34	187	45	141	57	111
20	18	353	28	227	37	172	46	138
22	15	423	23	276	30	212	38	167
24	13	488	19	334	25	254	32	199
26	11	577	16	397	22	289	27	235
28	9	706	14	454	19	334	23	276
30	8	794	12	529	16	397	20	318

Future Nesting Habitat

Alternatives C, D, and E have as an objective provision of future nesting habitat throughout the general forest area through extension of rotation lengths (or establishment of no rotation in the case of alternative D). Therefore, there is a need to discuss provision of future nesting habitat in the area outside clusters, replacement and recruitment stands.

The RCW Recovery Plan (USDI 1985) offers the land manager four options to provide potential future nesting habitat for RCW. These options are:

- Establish longer rotations,
- Leave remnant old growth trees well distributed throughout younger stands (protection of relicts),
- Perpetuate small remnant stands or patches of old growth throughout the forest area (replacement and/or recruitment stands),
- Or a combination of these methods.

All alternatives require the production of a continual supply of potential cavity trees which are essential to the survival and recovery of the RCW. Each alternative utilizes one or more of the above methods to provide these trees.

Conner and Rudolph (1995) suggest potential cavity trees need a minimum of 5 inches, and preferably 7-8 inches, of heartwood at cavity height to support a cavity.

The sustained production of cavity trees requires that enough trees become old enough with a high enough incidence of heart rot to offset the mortality in existing older trees. The RCW prefers to excavate its cavities in trees infected with this wood decaying fungus.

Thinning of overstory pine trees is an important activity to enhance or protect potential RCW nesting habitat. Thinning increases the distance between trees and thus reduces the risk of southern pine beetle infestations. Thinning also increases the openness of stands too dense for optimal RCW nesting habitat as well as improving the stands health and vigor.

To provide future nesting habitat in the shortest period of time Alternatives A, C, and E require retention of the trees (by forest type) on the oldest third of existing acres within the HMA (or the 3/4-mile radius circle in Alternative A) until they reach rotation age. For example, if an HMA contained 21,000 acres of longleaf pine, one third (7,000) of the acres occupied by the oldest trees would not be regenerated until they reach 120 years of age. On those acres being managed with even-aged systems, given the rate of regeneration allowed under a 120 year rotation (8.3% each 10 year entry period), a significant portion of the oldest third would grow 40 years beyond rotation before being harvested. In areas being managed with uneven-aged systems, tree marking guidelines must be modified to ensure retention of relicts or other potential cavity trees as a component of the larger diameter classes.

On those areas managed with even-aged systems, there is one possible exception to the requirement to retain the oldest 1/3 until rotation age. As a district/forest works through the standard forest regulation exercise, it may be desirable to regenerate part of the oldest 1/3 before it reaches rotation age to facilitate achieving regulation. In such cases, any regeneration would not occur until the oldest 1/3 is within 10-20 years of rotation and the regeneration must occur in the youngest end of the oldest 1/3. Continuing with the example in the previous paragraph: A total of 1743 acres could be regenerated each 10-year period (21,000 ac. X 8.3%). Assuming a worst case scenario in which all regeneration acres needed to come from the oldest 1/3 for two 10-year periods prior to reaching rotation, (in several sample regulation exercises only one HMA required any cutting in the oldest 1/3 and then only a portion of the necessary regeneration was taken from the oldest 1/3), 3486 acres (2 X 1743) would be cut from the youngest end of the oldest 1/3 prior to reaching rotation. The remainder of the oldest 1/3, 3514 acres (7000 ac.-3486 ac.) would still grow 20 years beyond rotation before being regenerated. This is not a blanket exception to retaining the oldest 1/3, but would be allowed only in specific situations.

The specific methods and criteria for providing potential cavity trees are described in individual alternative descriptions.

Thinning

After a new stand is established, a long period follows during which trees grow through various stages until they are ready for replacement by a succeeding generation. Various intermediate cuttings or tending operations may be made during the life of the stand from the regeneration stage to maturity.

In general, thinnings are made in overdense stands and result in reducing the number of existing trees before natural death by suppression. The number of trees per acre is reduced as it would be under natural conditions, but at a substantially faster rate (Smith 1986). Thinnings also provide more growing space for the remaining dominant and codominant trees. Ideally, thinnings should be made in most cases before the live-crown ratio is less than 40 percent.

If the live-crown ratio decreases to 30 percent or less as it can in dense stands, there will be a substantial loss of diameter growth. If the live-crown ratio is very low, the effects of thinning will, at best, be delayed or the tree may even die (Smith 1986).

Stagnation in a very dense young forest stand occurs when all trees in a stand grow in height at an equal rate, diameter growth rate continues to decrease because of small live-crown ratio and crown size, and later all trees slow in height uniformly. These type stands have very low tree vigor and high mortality and will not respond to thinning (Oliver and Larson 1990).

Thinnings allow more light to the forest floor which favors some herbaceous and woody plants (Oliver and Larson 1990).

Following is a brief discussion of how the various pine species used by RCW respond to thinning:

<u>Longleaf pine</u> in young even-aged stands almost never stagnate because they break up rapidly into a broad range of size classes due to variation in time spent in the grass stage. Even suppressed trees will slow the growth of dominant neighbors. In an overdense stand, dominant and codominant trees which have crowns equal to at least one-third to one-half of total tree height respond promptly to release from neighboring trees with increased diameter growth. Some intermediate trees that retain crown ratios of 30 percent or more will respond with increased growth (Boyer 1990b). Boyer states, "Suppressed trees, while they may continue to live, rarely respond to release with improved growth."

<u>Shortleaf pine</u> trees in young, well stocked stands begin to compete with each other within a few years after establishment and diameter growth declines. Shortleaf pine trees persist in very dense stands (Lawson 1990). Overstocked stands particularly on poor sites tend to stagnate (Smalley 1986). Lawson (1990) reports, "Shortleaf pine usually responds well to release, even when the trees are mature."

"<u>Loblolly pine</u> expresses dominance early, and various crown classes develop rapidly under competition on good sites; but in dense stands on poor sites, expression of dominance and crown differentiation are slower" (Baker and Langdon 1990). Diameter growth increases after release are related to live-crown ratio and crown growing space, usually small diameter trees respond more than large diameter trees. Suppressed loblolly pine trees respond in varying degrees to release but usually never attain the growth rate of trees that were never suppressed (Baker and Langdon 1990).

<u>Slash pine</u> in dense young stands tend to stagnate. Overstocked stands of slash pine should be thinned before age 5. Early thinnings are required to maintain an adequate live-crown ration in slash pine. A first thinning at about age 20 on the average site and a second near age 30 should result in sufficient live-crown ratio to maintain good growth in the latter part of the rotation. Thinning at older ages usually results in little more than maintenance of the present diameter growth rate (Folwells 1965, Bennett and Jones 1983).

<u>Virginia pine</u> is a shallow-rooted species which is subject to windthrow and damage from ice and snow if stands older than 7 to 10 years of age are thinned (Carter and Snow 1990).

Thinning of forest stands is a key activity in the production of good RCW habitat. Thinning in even-aged stands is the primary silvicultural activity to create the open park-like stands preferred by the RCW, to reduce the risk of southern pine beetle infestations and to speed up development of suitable foraging and nesting habitat. Thinning, if conducted regularly throughout the life of the stand, increases the trees ability to withstand high winds. This is especially important in coastal plain populations which are very susceptible to hurricanes (Hooper and McAdie 1995).

All alternatives establish guidelines for thinning pine and pine-hardwood stands (except Virginia and sand pine) which vary depending on the suitability of the stand to be thinned as RCW foraging habitat.

In stands not considered suitable as foraging habitat (smaller than 10-inches diameter) thinning is encouraged and can take place at any time. Standard silvicultural thinning guidelines will apply (see Appendix E).

Stands within 1/2 mile of active clusters or recruitment stands which are considered suitable RCW foraging habitat (10-inch diameter or larger and 30 years old or older) may be thinned after the availability of foraging habitat has been evaluated. If the proposed thinning does not reduce the available foraging for any RCW group or recruitment stand below acceptable levels, the thinning can proceed using guidelines specific to the alternatives. These guidelines are described in the individual alternative descriptions.

If foraging habitat is limited, thinnings will normally not occur. However, situations may arise where specific needs of the RCW may make thinning desirable even though foraging may be limited. In these cases, the Forest Service must conduct a site-specific analysis and informally consult with the Fish and Wildlife Service prior to thinning.

Forest Management and Sustaining RCW Habitat

A goal of forest management and the objective of forest regulation is to render a forest the source of an indefinitely sustained and uniform flow of benefits and services. Regulation is obtained at the forest (landscape level) and not at the stand level. The forest, not the stand, is the unit from which a sustained annual yield of products and benefits is provided. The longer the production cycle of the benefit or the age of the stand on which it is dependent, the more difficult the goal of sustained yield and uniform flow becomes, because it takes decades to grow trees to a certain size or age (Smith 1986).

To provide a sustained uniform flow (yield) of RCW habitat indefinitely requires that each annual age and/or size class of pine trees from Year 1 to recommended rotation age (which will be harvested and replaced each year) be equally represented in the areas managed for RCW. This balance of different stand structures and spatial patterns can provide habitats for a diversity of plants and animals (Oliver 1992).

<u>Young pine stand management</u>--The requirements for establishment, growth, and development of young pine trees (Oliver and Larson 1990) is the same whether for RCW habitat or for timber production. Stocking of seedlings, saplings, or pole-size trees should not be too dense or too sparse. Density should be low enough to maintain tree vigor but high enough to encourage natural pruning of limbs. The negative effects of residual older trees on establishment, growth and development of the young pine trees is the same whether for RCW habitat or timber production, and must be taken into account.

Older pine stand management--The goal of providing potential cavity trees to meet the needs of a population of RCW focuses on growing pine trees to a size and age where an adequate number will develop sufficient heartwood and red heart (Phellinus Pini) for cavity excavation. In contrast, management for timber production focuses on growing healthy, sound trees (no decay) to a desired size. At our current level of understanding, the primary difference in providing potential cavity trees and prime sawtimber is the age to which trees are allowed to grow.

Rotation and Regulation

For the following discussion, rotation age refers to the oldest age class grown before an even-aged or two-aged regeneration method is used to produce a new age class and/or the maximum size class grown before an uneven-aged regeneration method is used to produce a new size class.

Rotation length affects the acres of forest in each age class, the maximum size of trees, the number of trees, and the age of the oldest trees. The longer the rotation the fewer acres and trees there will be in each age class (Davis 1966). For a given rotation, soil properties, site quality, stocking, growth rate, disturbances, and tree species largely determine the number of trees in each age class (Smith 1986).

The successful regeneration, growth, and development of adequate numbers of pine trees is essential to providing RCW habitat in the long-term. It is only through the successful reestablishment of pine and pine-hardwood stands that a sustained uniform flow of RCW foraging and nesting habitat can be provided through time. Selection of appropriate rotation ages for a wide variety of sites allows planned regeneration where the probability that most stands have adequate tree vigor and health (except for catastrophic events) to maintain a reasonable level of stocking. Maintaining adequate stocking reduces the odds of isolating clusters and fragmenting habitat. Poor sites may only produce foraging habitat. Those sites do not have the capability to produce potential nesting habitat or may not be able to sustain it for even a short period of time.

A forest is regulated when the area in each age class and/or size class is represented in equal proportion and consistently grown to provide a continual and approximately equal amount of outputs indefinitely (Davis 1966). Regulation applies whether these products are cavity trees or high quality pine sawtimber.

Even-aged and two-aged forest will be regulated for sustainable yields over time by area control. The area control method of regulation allows a certain amount of land area to be regenerated in a given period, usually 10 years. The longer the rotation, the fewer acres which may be regenerated in that period.

Following is an explanation of how the area which can be regenerated per decade for a given rotation length is determined:

> In its simplest terms, area control is calculated by the formula A/R x T, where A = area under management, R = rotation length, and T = the time of each entry cycle.
>
> As an example, consider a 10,000-acre HMA. The rotation, or that period of time between reforestation and regeneration cutting, is 100 years.

Therefore: **A / R x T**

$$\frac{\text{10,000 acres}}{\text{100 years}} \times \text{1 year} = \text{100 acres}$$

For this example, 100 acres (or 1 percent of the area) could be regenerated from the 10,000-acre block every year in perpetuity. The remaining 9900 acres are evenly divided into a range of age classes from 1-99 years.

When calculating age class distributions, do not include HMA acres which are being managed with an uneven-aged method, or identified as unsuitable for timber management, i.e., RCW clusters. All age class distribution calculations will be based on post harvest acres and should use the expected date of the timber sale to determine when the stand goes into the 0-10 year age class.

Uneven-aged stands will be regulated by diameter distribution. The distribution should approximate the collective total of the diameter distributions of a series of little even-aged, groups of pine trees covering equal areas and separated by equal intervals of age (Smith 1986). The BDQ (basal area, maximum diameter, and constant ratio of trees in successions of diameter classes) method (Farrar 1984, Farrar and Murphy 1989) will be used to create and maintain a balanced uneven-aged structure.

The criteria to determine allowable regeneration acres and the situations where specific regeneration methods may be used vary by alternative and are described in the respective alternative descriptions.

Tree Health and Longevity

Soil, site, and climate are the principal factors that alter the expected longevity of each tree species. Competition, senescence, and external factors such as insects, diseases, wind, and lightning are the main reasons that overstory trees die.

<u>Longleaf pine</u> matures at about 100 years and can live to over 300 years (Hepting 1971).

The ecology of longleaf pine differs so much from the other pine species used by RCW that it warrents a brief description. Given optimum conditions, longleaf seed germinates soon after dispersal. However, the seedlings may not exhibit height growth for two to many years. Instead they remain in a stemless condition, in which the seedlings resemble tufts of grass, thus this period of longleaf's development is referred to as the "grass stage". While in the grass stage the seedlings develop extensive root systems, it is also during this period that seedlings are most susceptible to its major disease, the brown-spot needle blight (<u>Scirrhia acicola</u>). Prescribed fire plays a key role in brown-spot control (Boyer 1990b). Longleaf is also resistant to the most serious insects and diseases that attack loblolly and slash pines. It withstands fire and can flourish under fire regimes that eliminate most other woody species (Boyer 1979).

Chapman (1923) reports, "Old age or senile debility claimed not over two trees (longleaf pine) on this area--about the same proportion, as for the human race. Something always happens first. One tree was found which resembled the "one hoss shay." Still alive, this battle-scarred veteran of 38 inches diameter was found to have required 50 years to increase a bare inch in size, while the last 10 inches in diameter represented the growth of 190 years. This tree was possibly 400 years old. The ordinary limit of age of this species (longleaf pine) is 300 years, and at that age, it can be expected that only one or two trees will survive of the original stand for every 20 to 40 acres of timber."

One large longleaf pine on the Wade Tract in south Georgia was reported to be over 450 years of age (Platt et al. 1988).

Some longleaf pine trees will live 200 to 250 years or longer. A few will live 300 years or longer on poor to good sites except where lightning strikes are followed by infestations of bark beetles (Ips spp.), where black turpentine beetles attack trees injured by logging or fire, or where subject to windthrow because a hardpan restricts downward growth of the taproot or where windthrow from hurricanes and tornadoes cause heavy damage (Mohr 1897, Chapman 1923, Boyer 1990b).

<u>Shortleaf pine</u> matures at about 120 years and can live up to about 300 years (Hepting 1971).

Few, if any, shortleaf pine trees will live 40 to 70 years on poorly drained soils due primarily to littleleaf disease/southern pine beetle complex. Some shortleaf pine trees will live to 150 years and a few will live over 200 years or longer on very shallow, rocky soils to deep, well drained soils having fine sandy loam or silty loam textures except where damaged by ice, wind, fire, or insects and disease (Hepting 1971, Belanger et al. 1986, Guldin 1986, Lawson 1990).

<u>Loblolly pine</u> matures at about 100 years and seldom lives over 220 years (Hepting 1971).

Most loblolly pine trees will not live to 50 to 80 years on poor sites or off site. Some loblolly pine trees on average and good sites will live to be 110 years old or older, and very few will live to 200 years or older (Wahlenberg 1960, Boyce 1961, Hepting 1971, Knight and Heikkenen 1980, Belanger 1981, White 1984, Belanger et al. 1986, Baker and Langdon 1990, Oliver and Larson 1990).

<u>Slash pine</u> matures about 100 years and can live to over 200 years (Hepting 1971).

Most slash pine trees will not live to 40 to 70 years off site or on poor sites such as well drained sands (sandhills) and on poorly drained savannah soils with high water tables. Most slash pine will not live to 100 years on inadequately drained soils where growth is intermediate. Some slash pine will live to be 100 years or older; on sites where soil is aerated and moisture is not excessive, some slash pines will live to 150 years or older. (Boyce 1961, Hepting 1971, Hebb and Clewell 1976, Knight and Heikkenen 1980, Belanger 1981, Lohrey and Kossuth 1990, Oliver and Larson 1990).

<u>Virginia pine</u> matures at about 80 years and can live to 200 years (Hepting 1971).

Few Virginia pine trees will live to 90 years (Hepting 1971, Bramlett and Kitchens 1983, Carter and Snow 1990).

One way of improving forest health and increasing tree longevity is to restore longleaf, shortleaf, slash, and loblolly pines to their natural sites, if they are currently occupied by another pine species. This would allow the site to grow trees that are more vigorous, less susceptible to insects and disease, and have the potential to live longer (Boyce 1961, Pritchett and Fisher 1987).

Intolerant, early successional species such as longleaf, slash, loblolly, shortleaf, and Virginia pine survive, grow, and develop best when free of competition and grown in full light (Baker and Balmer 1983, Burns 1983, Baker 1987, Zedaker et al. 1987, Boyer and White 1990). The relative intolerance of these species varies. For example, longleaf pine is especially intolerant of competition from any source, especially overtopping trees including parent trees. Over a 35-year period, basal area growth of the young longleaf pine trees was reduced about 48 percent under 9 square feet of basal area per acre of parent trees and approximately 62 percent under 18 square feet as compared to the stand where the shelterwood seed trees were removed (Boyer 1993).

Regeneration and Sustaining RCW Habitat

Trees, like all living things, do not live forever. The art of replacing old trees, either naturally or artificially, is called regeneration. This term also applies to the new growth that develops. Regeneration cuttings are made to remove the old trees and create environments favorable for establishment of regeneration (Smith 1986).

The primary ecological and physiological factors that affect establishment, survival, growth, and development of the desired tree species include percentage of canopy removed in the residual stand, root competition of residual trees, seed supply from residual trees, direct solar radiation, diffuse solar radiation, and competing vegetation (Spurr and Barnes 1980, Smith 1986, Oliver and Larson 1990). Management can control some of these factors to enhance the establishment of new stands.

The condition of the forest overstory, midstory, ground cover, and soil determines the choice(s) of regeneration methods and the type(s) of site preparation needed. In many stands, the choice of site preparation method(s) has more influence on the new stand than the regeneration method. Site preparation method(s) are used to insure the desired species composition by altering the microsite conditions to insure establishment of the desired species. Site preparation methods available for use are prescribed fire, mechanical, manual, herbicides, and biological (USDA Forest Service 1989a, pages IV-30 to IV-52).

Intolerant, early successional tree species, such as longleaf, slash, loblolly, shortleaf, and Virginia pine; survive, grow and develop best when free of competition and grown in full light. The relative intolerance of these species varies.

Regeneration methods for the southern yellow pines include single-tree selection and group selection for uneven-aged stands; irregular shelterwood for two-aged stands; and shelterwood, seed-tree, and clearcutting for even-aged stands. Regenerating a new age class of trees in a forest involves replacing old trees with new trees of the desired species.

Some species (e.g., Virginia pine) can only be regenerated by the clearcut method, while other species (e.g., loblolly and longleaf pine) can be regenerated by one of several different methods (Burns 1983, Baker 1987, Smith 1986).

Even-aged Silviculture for RCW Habitat

Even-aged silviculture refers to regeneration methods that produce stands of trees where the main canopy level is dominated by trees essentially of the same age or at least of the same 10-year class. A stand is considered even-aged if the difference in age between the oldest and youngest trees in the main canopy level does not exceed 20 percent of the rotation length. Some even-aged stands may have a few individuals or clumps of older trees or small gaps filled with younger trees, randomly distributed, which do not significantly affect the even-aged stand structure.

An even-aged stand of one species usually has a canopy top primarily at an uniform height when viewed at stand level. Stand boundaries are usually distinct. An even-aged stand when viewed from different points usually has the same general appearance. A forest of even-aged stands, with balanced distribution of age classes, when viewed at the landscape, level are irregular in height and the forest is all-aged.

The three even-aged regeneration methods are clearcutting, seed-tree, and shelterwood. The methods differ according to the number of cuttings required to remove the mature stand.

Clearcutting Method for Even-aged RCW Habitat

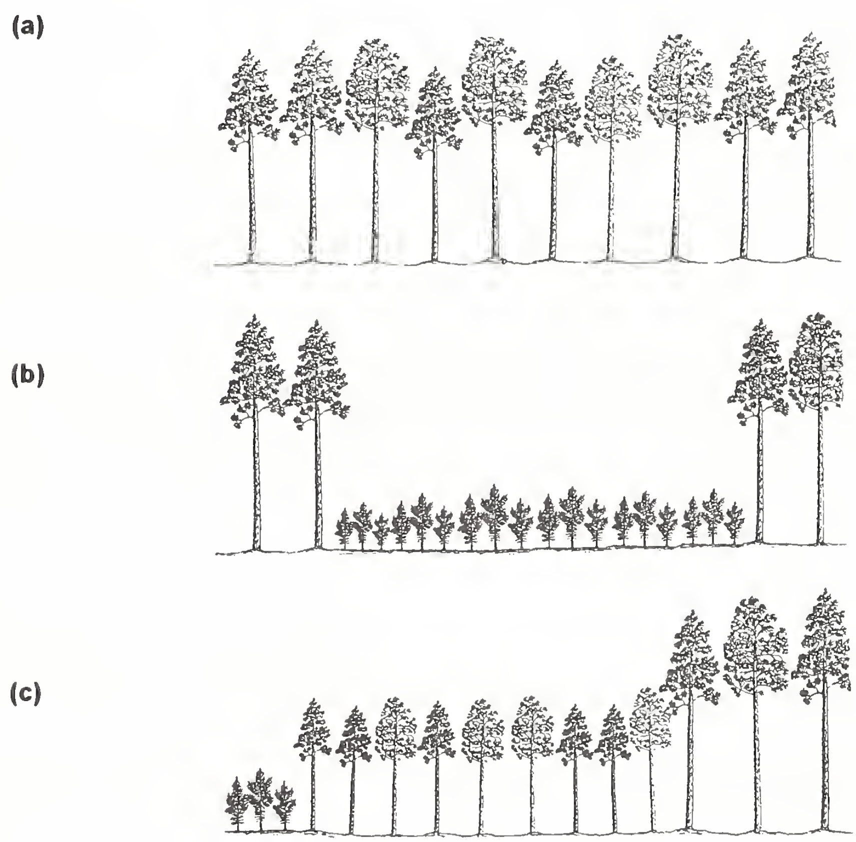
The clearcutting method of regeneration involves removal of the entire stand (main canopy level) in one cutting operation. Regeneration can originate naturally or artificially, and sometimes is assisted by site preparation methods which allow the new trees to become established and survive (Smith 1986). The planting of seedlings is the most commonly used method.

The clearcutting method has been successfully used to regenerate loblolly, shortleaf, longleaf, slash, and Virginia pine in even-aged stands (Baker 1987).

The use of clearcutting has been limited in all alternatives to conform with the Chief's 1330-1 letter dated June 4, 1992 and with NFMA at 16 U.S.C. 1604 (g) (3) (F) (1). In keeping with this direction the amount of clearcutting will not vary significantly among the alternatives. This method will be used only where it is the optimal regeneration method to achieve a specific management objective, such as restoring a pine species desirable to RCW.

Figure 2-4 shows how a even-aged stand may look (a) prior to regeneration cutting, (b) for the first few years after regeneration cutting, and (c) several years later .

Figure 2-4
Ground View of Clearcutting
All trees within a stand are harvested in one cutting and are replaced by a new even-aged stand.



Seed-tree Method for Even-aged RCW Habitat

The seed-tree method of regeneration involves removal of the stand (main canopy level) in one cutting, except for a small number of seed trees left singly or in small groups (typically 6 to 12 square feet of basal area per acre). Well distributed dominant and codominant trees of seed-bearing size on soils that do not cause the trees to be shallow-rooted which predisposes them to windthrow are necessary when using the seed-tree method. The establishment of essentially even-aged regeneration under the seed trees is encouraged, and sometimes is assisted by site preparation practices (Smith 1986). The seed trees are usually removed after the seedlings are securely established, usually within two to five years.

The seed-tree method has been successfully used to regenerate loblolly, shortleaf, and slash pine in even-aged stands (Baker 1987).

Shelterwood Method for Even-aged RCW Habitat

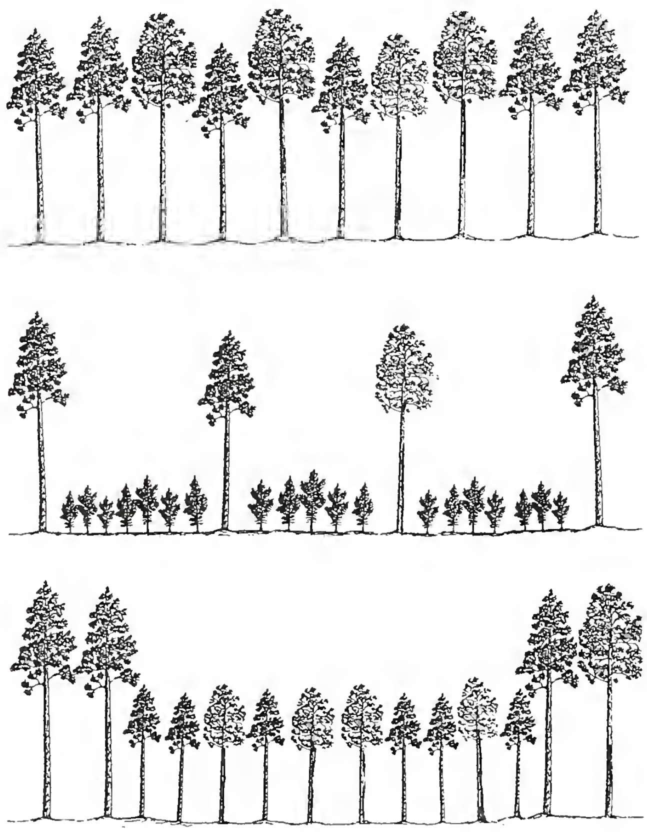
The shelterwood method of regeneration involves removal of the stand (main canopy level) in a series of cuttings (usually two or three) over a relatively short portion of the rotation (Boyer 1963). Well distributed dominant and codominant trees of seed-bearing size (usually 20-30 square feet of basal area per acre) on soils that do not cause the trees to be shallow-rooted which predisposes them to windthrow are necessary when using the shelterwood method. The establishment of essentially even-aged regeneration under the seed trees is encouraged, and sometimes is assisted by site preparation practices (Smith 1986). The seed trees are usually removed after the seedlings are securely established, usually within two to five years.

The shelterwood method has been successfully used to regenerate loblolly, shortleaf, longleaf, and slash pine in even-aged stands (Baker 1987).

Figure 2-5 shows how an even-aged stand would look (a) prior to regeneration cutting, (b) for the first few years after regeneration cutting (seed trees still remain), and (c) several years later (seed producing trees removed).

Figure 2-5
Ground View of Seed-tree or Shelterwood
All trees within a stand are harvested in two or more cuttings and are replaced by a new even-aged stand.

(a)
(b)
(c)



Two-aged Silviculture for RCW Habitat

Two-aged silviculture refers to the irregular shelterwood regeneration method that produces a stand of trees that contains two age classes for long periods of time or for most of the rotation. The difference in age between the oldest and youngest trees in the two canopy levels is greater than 20 percent of the rotation. Each age class is basically even-aged, with the oldest age class usually being the parent trees for the younger age class. The younger age class will have additional tree height variance due to their proximity to trees in the older age class, such that the tallest are in the most open areas.

Two-aged stands of one species when viewed from the side will usually have an irregular canopy for a long period of time. Stand boundaries may or may not be distinct depending on growth and development of the younger age class and the remaining number of parent trees in each stand.

Irregular Shelterwood Method for Two-aged RCW Habitat

The irregular shelterwood method of cutting for regeneration involves the removal of trees in a series of cutting (usually two or three), similar to even-aged shelterwood methods, where establishment of essentially even-aged regeneration is encouraged. The irregular shelterwood method differs in that the final cut may occur later in the rotation or not at all. If most of the parent trees are removed, the stand would be essentially even-aged. Trees in this stand structure will usually be very irregular in height and diameter within the new age class as well as between the two age classes. The irregular shelterwood method can only be used in stands with sufficient, well-distributed dominant and codominant trees of seed bearing size (possibly 25-40 square feet of basal area per acre) and on sites which do not cause those trees to have shallow-rootedness which predisposes them to windthrow (Smith 1986).

There are three basic overstory conditions that can occur depending on size (age) of parent trees which could affect the growth and development of the new stand.

In two-aged stands, the growth and development of the older age class (parent trees) will pass through one of three major conditions depending on age (size): (1) The basal area per acre in parent trees increases at various rates for many years before stabilizing and then declining. (2) The basal area per acre in parent trees remains constant for many years because growth and mortality balance out before declining. (3) The basal area per acre in parent trees decreases because mortality exceeds growth. The effects on the new age class of pine and other vegetation depends on the number, size, and basal area increase or decrease of pine parent trees, soil and site conditions, and mortality patterns.

Because of the above conditions, the number of large trees that can be grown over a rotation period in the new age class is much more variable with a two-aged stand than with even-aged or uneven-aged stands.

The irregular shelterwood is an untested regeneration method for loblolly, shortleaf, and slash pine. This method has been tested in longleaf pine over a 35-year period. (Boyer 1993).

The density of parent trees retained which creates an irregular stand structure in longleaf pine stands occurs with about 9 square feet of basal area per acre (Boyer 1993) or may in loblolly, shortleaf, and slash pine stands range from about 20 up to possibly 40 square feet of basal area per acre, depending on soils and site conditions.

It is not certain that the irregular shelterwood method could supply a steady flow of RCW habitat in the long-term on many acres particularly where the parent trees (overwood) growth exceeds mortality for 10-20 or more years. A staged reduction in the parent trees on these sites would be required to prevent many trees in the younger age class from dying or being severely suppressed.

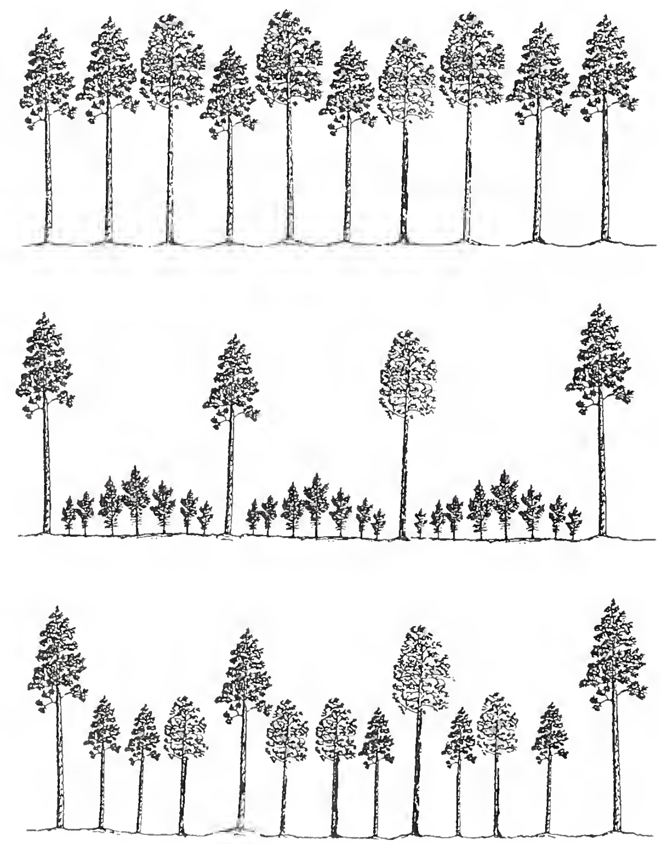
Figure 2-6 shows how an even-aged stand may look (a) prior to regeneration cutting, (b) for the first few years after regeneration cutting, and (c) several years after regeneration (a two-aged stand) .

Figure 2-6
Ground View of Irregular Shelterwood
The trees remaining after the initial cut may be gradually removed or lost to mortality over the term of the new stand's rotation or left standing for an indefinite time creating a two-aged stand.

(a)

(b)

(c)



Uneven-aged Silviculture for RCW Habitat

Uneven-aged silviculture refers to the regeneration systems and methods that produce uneven-aged stands. The theoretical balanced uneven-aged stand would have trees of each age and/or size class from seedlings to mature trees of rotation age and/or maximum tree size, with each age and/or size class occupying an equal area. Structure in the merchantable component (usually six-inch and larger diameter classes) of the stand is best maintained by the BDQ (basal area, maximum diameter, and constant ratio of trees in successive diameter classes) method (Farrar 1984, Farrar and Murphy 1989, Farrar and Boyer 1991).

Some tree characteristics preferred by the RCW are age-dependent. Therefore, maximum diameter cutting limits must be set large enough to ensure trees old enough to provide these desirable characteristics. For example, longleaf pine takes 90-100 years to develop the characteristics of a potential nest tree. It is not desirable to harvest such trees as soon as they become potential cavity trees. Therefore, to allow some period of time for RCW to find and utilize them, they should not be cut before reaching 120 years of age. Longleaf growing in an all aged stand on a good site (site index 80) may grow to an average diameter of 17 inches in 120 years. Therefore, the diameter cutting limit for longleaf on this site would need to be 17 inches or greater to ensure trees old enough to become cavity trees. A site-specific study must be completed to determine the relationship between size and age before setting the appropriate maximum diameter limit.

If RCW nesting habitat is an objective, the tree marking guidelines for uneven-aged stands must be modified to leave relict and other potential cavity trees as a component of the larger diameter classes.

Where the objective is to grow the maximum number of large pine trees with uneven-aged silviculture, the average stand basal area should range from about 60 square feet per acre after harvest to 75 square feet per acre before harvest. The one inch Q for this objective should be 1.1 for loblolly pine and 1.2 for longleaf pine, and the maximum diameter depends on site productivity and age.

To maintain an adequate uneven-aged stand structure, establishment of pine regeneration is usually necessary at least once every 10-year period.

A balanced uneven-aged stand of one species has an irregular stand structure and canopy whether viewed at the stand level or landscape level (Hunter 1990). The stand viewed from the side shows many groups of pine trees with different height and diameter classes. A pine midstory is usually present and/or developing. Stand boundaries tend to disappear in parts of the forest where uneven-aged methods are used.

The two uneven-aged regeneration methods are group selection and single-tree selection.

Group Selection Method for Uneven-aged RCW Habitat

The group selection method of regeneration involves removal of trees, usually the oldest or largest trees, in scattered patches at relatively short intervals (about every 10 years), repeated indefinitely, to encourage the continuous establishment of regeneration and maintenance of a balanced uneven-aged stand (Farrar 1984, Smith 1986). A balanced uneven-aged stand managed by using the group selection system is made up of essentially even-aged groups of pine trees. Each size class, ranging from seedlings to large trees, would occupy approximately the same number of acres in each stand but would be arranged in a number of openings ranging from about 1/4 to 2 acres in size.

The group selection method should work to regenerate uneven-aged stands of loblolly, shortleaf, and longleaf pine on some sites (Baker 1987). Use of the group selection method to regenerate longleaf pine on medium sites has been tested for about 15 years. Farrar and Boyer (1991) state: "A selection system may not work well for longleaf pine on very poor, dry, sandy sites, wet flatwood sites with dense palmetto understories, or very good mesic sites, because prescribed burning for competition control and/or seedbed preparation may be difficult to achieve."

Figure 2-7 shows how an even-aged stand planned for conversion to an uneven-aged stand structure using the group selection method may look (a) prior to regeneration cutting, (b) after the first cutting cycle, and (c) after several cutting cycles.

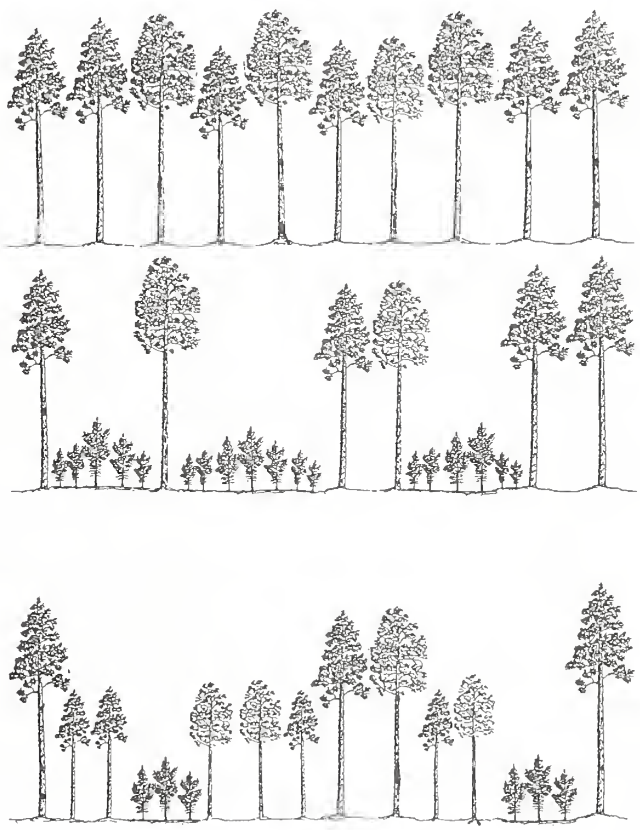
Figure 2-7
Ground View of Group Selection

Small groups of trees (1/4 to 2 acres) are removed approximately every 10 years, making small openings which are naturally seeded. The seedlings in the center of the cut grow faster than along the edge because of less shade and competition for moisture and nutrients from the surrounding trees.

(a)

(b)

(c)



Single-Tree Selection Method for Uneven-aged RCW Habitat

The single-tree selection method involves removal of selected pine trees from all merchantable diameter classes (usually 6" DBH and larger) at relatively short intervals (3- to 15-year intervals, depending on stand basal area growth), repeated indefinitely, to encourage the establishment of scattered pine regeneration throughout the stand usually under high pine shade and maintenance of a balanced uneven-aged stand structure (Farrar 1984, Smith 1986, Farrar and Murphy 1989). Care must be taken not to reduce genetic quality and diversity by cutting only the best dominant individuals (high grading).

The single-tree selection method is best adapted to tolerant, late-successional species, but has been successfully used to regenerate loblolly and shortleaf pine in uneven-aged stands, provided hardwood competition is controlled on a regular basis (Baker 1987). Boyer (1993) states this method is not appropriate to regenerate longleaf pine because of this species intolerance to competition from any source, especially overtopping trees. It is assumed Boyer's statement is made in the context of maximizing timber production.

Platt et al. (1988) and others suggest that longleaf perpetuates itself primarily through a system much like single-tree selection. Growth of regeneration may be very slow, taking 70-100 years to grow foraging size trees.

Figure 2-8 shows how an even-aged stand planned for conversion to an uneven-aged stand structure using the single tree selection method may look (a) prior to regeneration cutting, (b) after the first cutting cycle, and (c) after several cutting cycles.

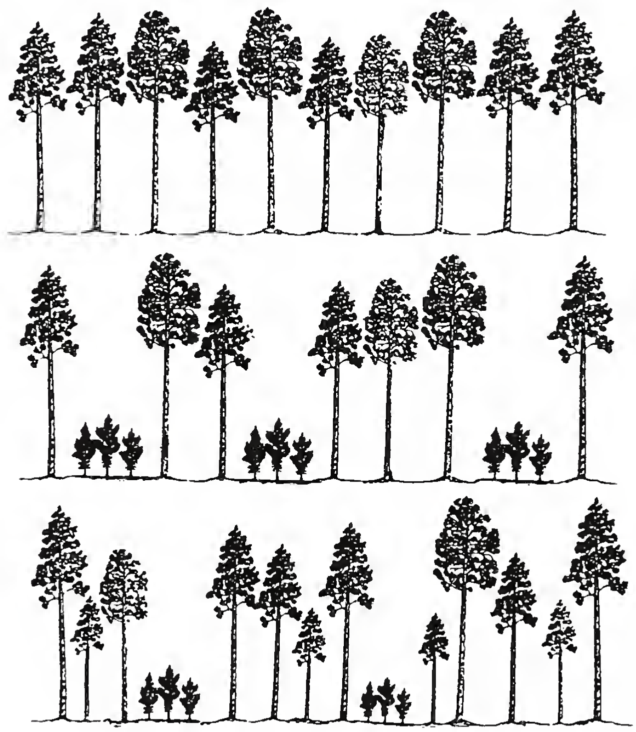
Figure 2-8
Ground View of Single-Tree Selection

Individual trees within the stand are removed every 3 to 15 years, and the opening is naturally seeded by the surrounding trees to produce a stand (over time) with varying age classes.

(a)

(b)

(c)



Single-tree selection can be used on loblolly, longleaf and shortleaf sites, but usually requires herbicide use to achieve desired hardwood control. It is difficult to burn intensively enough to control hardwood midstory without destroying the pine regeneration.

Single-tree selection does not generally produce suitable nesting habitat in loblolly, longleaf and shortleaf pine, because such all-aged stands develop a heavy, but necessary, pine midstory. It is not recommended for managing areas where production of nesting habitat is an objective.

Table 2-6 compares the various regeneration methods by pine forest type.

Table 2-6. Comparison of Regeneration Methods for Pine Forest Types.

Condition	Clearcutting	Shelterwood	Irregular Shelterwood	Group Selection	Single-tree Selection
A. Open park-like stand is desired future condition	Horizontal structure-low understory	Horizontal structure-low understory	Vertical Structure for many years-pine mid-story around the residual parent trees and then the younger age class crown levels merge with parent trees-tree heights usually very variable within the new stand	Vertical structure-pine mid-story scattered throughout stand	Vertical structure-pine mid-story on all acres
1. Pine mid-story as part of stand structure	No	No	Yes, 20 to 30 years or more	Yes	Yes
2. Hardwood mid-story	Controlled	Controlled	Controlled	Controlled	Controlled
a) Prescribed Burning frequency is usually adequate to control most hardwoods after pines reach a fire-resistant stage	Yes, after herbicide treatment in some stands	Yes, after herbicide treatment in some stands	Usually takes 10 or more years longer than even-aged stands and after herbicide treatments in most stands	No, even with periodic herbicide treatments	No, even with periodic herbicide treatments
b) Herbicide treatments per 100 years to control hardwoods	1 to 2 times	1 to 3 times	2 to 4 times	5 times - longleaf, 5 to 10 times - loblolly and shortleaf	6 to 10 times
B. Stand structure by species and methods					
1. Virginia Pine	Even-aged	NA	NA	NA	NA
2. Longleaf Pine	Even-aged	Even-aged	Two-ages to even-aged	Uneven-aged	Uneven-aged
3. Slash pine	Even-aged	Even-aged	Two-aged to even-aged	NA	NA
4. Shortleaf pine	Even-aged	Even-aged	Two-aged to even-aged	Uneven-aged	Uneven-aged
5. Loblolly pine	Even-aged	Even-aged	Two-aged to even-aged	Uneven-aged	Uneven-aged

ALTERNATIVES CONSIDERED IN DETAIL

Following are descriptions of the five alternatives considered in detail. They are rather complex. In an attempt to make them more understandable, the use of technical jargon and acronyms has been kept to a minimum. Reference is frequently made to the section on common activities. This is intended to avoid repetition in the alternative descriptions.

Alternative A (No Action)

SUMMARY - ALTERNATIVE A

Alternative A is the Interim S&Gs, the direction currently guiding RCW management on all national forest except the National Forests in Texas. The area managed for RCW is 3/4-mile radius circles around all active and inactive clusters.

This alternative is described in detail in this chapter. The current conditions affecting the RCW and environmental effects are described in Chapter 3.

REVISED HANDBOOK

The Forest Service proposes to revise the Regional Wildlife Habitat Management Handbook, FSH 2609.23R (Handbook) and amend the Southern Regional Guide to incorporate the revised Handbook immediately after the Record of Decision. The revised Handbook would make the Interim S&Gs, the regional direction for managing the red-cockaded woodpecker and its habitat. This direction is currently being implemented under existing Forest Plans.

Elements of the Proposed Handbook Revision

Alternative A would:

(1) Establish Regional Handbook direction for management of the red-cockaded woodpecker and its habitat.

- Emphasize the use of artificial cavities and the moving of RCW from area to area (translocation) to speed population expansion and eventual recovery of the species.

- Continue to manage RCW within the existing 3/4-mile radius circles around all active and inactive RCW clusters (colony sites) and establish population objectives currently in the Handbook.

- Establish sufficient recruitment stands to provide clusters to meet population objectives within existing 3/4-mile radius circles.

- Establish three different management intensity zones, a high-intensity zone surrounding the cluster for 1/4 mile and a moderate intensity zone forming a "donut" between 1/4- and 3/4-mile from each cluster. The area outside the 3/4-mile zone would be managed according to Forest Plans as amended.

- o Utilize irregular shelterwood as the primary regeneration method, with even-aged management allowed in specific situations.

- o Limit regeneration of the oldest 1/3 of pine and pine-hardwood acres until they are within 10-20 years of rotation age. This will ensure suitable potential cavity trees in the shortest time.

- o Establish a timber rotation of 120 years for all pine species within 3/4 mile circles by allowing no more than 8.3 percent and 25 percent in the 0-10 and 0-30 age classes, respectively.

- o Emphasize thinning to reduce southern pine beetle risk and enhance RCW habitat.

- o Emphasize prescribed fire, including growing season burns, to control midstory vegetation in the pine and pine-hardwood forest types throughout 3/4 mile circles, especially within clusters.

- o Provide adequate foraging habitat (6350 pine trees greater than 10" diameter, 30 years old or older within 1/2 mile of and connected to the clusters).

- o Encourage restoration of longleaf pine in areas where it occurred historically and would provide better habitat for the RCW.

(2) Establish monitoring requirements to determine if the objectives of the new RCW management direction are being met.

- o Link monitoring intensity to the size and vulnerability of the RCW population.

IMMEDIATE ACTIONS

The Forest Service would continue to manage the national forests where the RCW lives under the Interim S&Gs described briefly in Chapter 1, which would affect management within the 3/4-mile radius circles around active and inactive clusters. The areas outside the 3/4-mile radius circles would be managed under current Forest Land and Resources Management Plans (Forest Plans).

DETAILED DESCRIPTION-ALTERNATIVE A

Habitat Management Areas

RCW management areas consist of 3/4-mile radius circles around all active and inactive RCW clusters. **Figure 2-A1** illustrates how this management strategy will appear when implemented. The population objectives shown in Table 2-A1 may be achieved in existing 3/4-mile radius circles. A 3/4-mile radius circle contains approximately 1130 acres. On average, 50 percent of each circle would be potentially suitable RCW habitat, pine or pine/hardwood. Therefore, each 3/4-mile circle should be able to support two active clusters.

Recruitment stands will be established in existing 3/4-mile radius circles in an effort to achieve the listed population objective.

Figure 2-A1
Management Strategy of 3/4-Mile Radius Circles and Surrounding Area as it May Appear on the Ground.

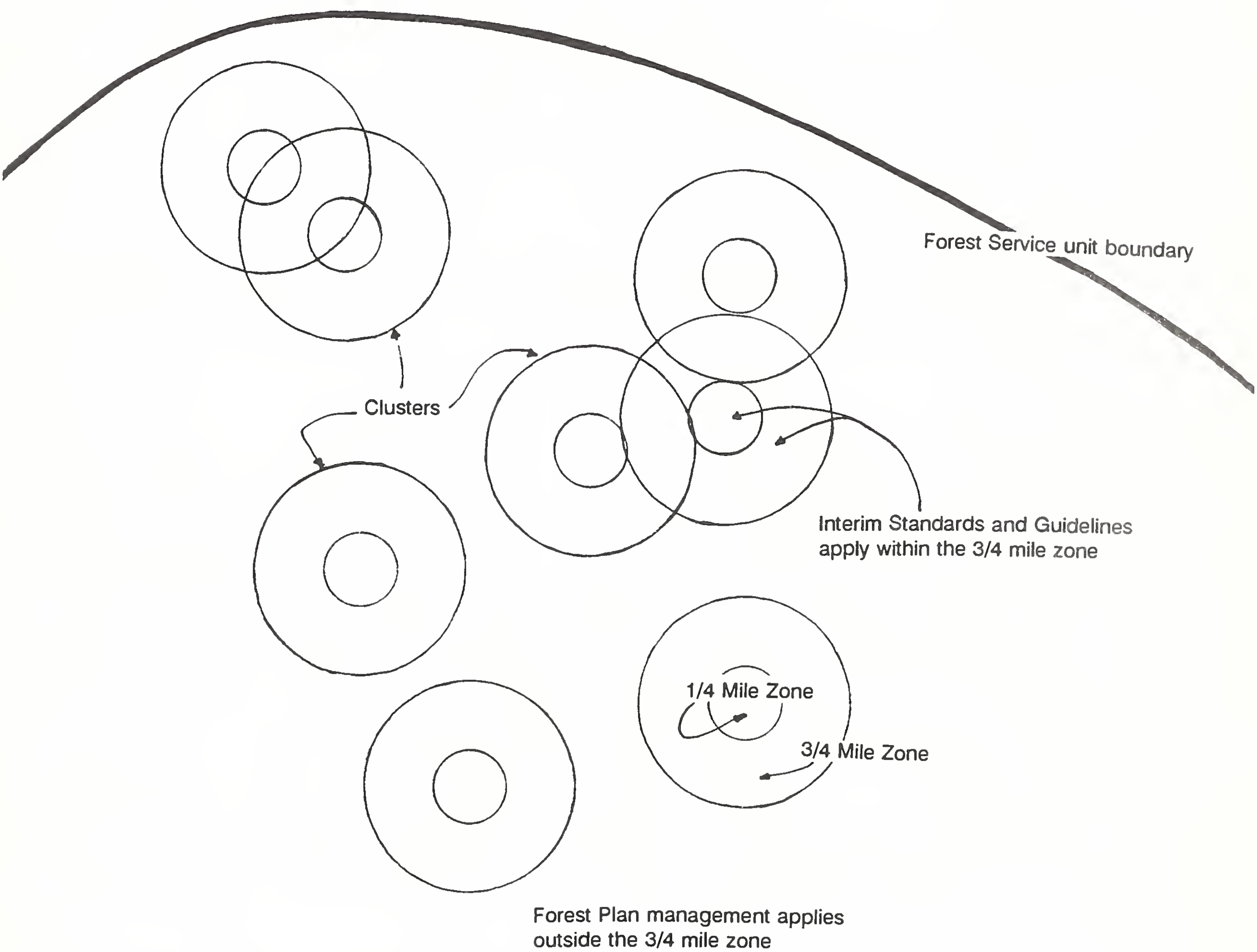


Table 2-A1
Tentative RCW Population Objective.

Tentative population objectives are based on existing active and inactive clusters (colony sites) and the 3/4-mile radius circles around them.

STATE	National Forests/ District (Recovery Pop. Und.)	Population 1994	Tentative Pop. Objective
		(Active Clusters)	
ALABAMA	Bankhead	0	50
	Conecuh	14	309
	Oakmulgee RD	120	394
	Talladega/Shoal Creek RDs	5	500
		138	1,253
ARKANSAS	Ouachita	15	50
FLORIDA	Apalachicola	650	826
	Ocala	4	125
	Osceola	45	490
		699	1,441
GEORGIA	Oconee/Hitchiti *	16	176*
KENTUCKY	Daniel Boone	3	50
LOUISIANA	Kisatchie-		
	Catahoula/Winn Rds	45	125
	Evangeline RD	52	70
	Kisatchie RD	69	100
	Vernon RD	186	321
		352	616
MISSISSIPPI	Bienville	92	500
	DeSoto	10	500
	Homochitto	27	125
		129	1,125
N.CAROLINA	Croatan	55	139
S.CAROLINA	Francis Marion	371	500
TENNESSEE	Cherokee	1	n/a
TEXAS	Angelina/Sabine	42	250
	Davy Crockett	38	125
	Sam Houston*	149	500
		229	875
SOUTHERN REGION		2,008	6,225

* The Oconee NF is combined with Hitchiti Experiment Forest and the Piedmont National Wildlife Refuge by Memorandum of Understanding (FSM 2609.23). The figures listed, however, show only the Forest Service population objectives.

The total area of pine and pine/hardwood forest type within these 3/4-mile-radius circles, an estimated 1.45 million acres, will be the area devoted to RCW management.

Setting Population Objectives

Interim S&Gs did not establish population objectives, therefore those in the RCW Chapter of the Handbook will be used. Table 2-A1 list the population objectives to be used with Alternative A.

Management Intensity Levels

This alternative does not have management intensity levels per se, but instead, management intensity zones. The 3/4-mile radius circle is broken down into two zones; the area within 1/4 mile of the cluster (1/4-mile zone) and the area between 1/4 mile and 3/4 mile (1/4-3/4 mile zone). More intensive RCW management/protection measures are applied in the 1/4-mile zone. Table 2-A2 summarizes the activities which can occur in each zone. More detailed information about what activities can or cannot occur within the separate zones is included in the section on Habitat Management (pages 88-94).

Establishment of Subhabitat Management Areas

The establishment of sub-HMAs is not a management option in this alternative because large contiguous HMAs are not established.

Table 2-A2
Summary of Proposed RCW Management by Management Intensity Zone.
The level RCW protection and management varies with distance from a cluster.

	Distance Zone		
	1/4 Mile Zone	**1/4-3/4 Mile Zone**	**>3/4 Mile Zone**
Population Size & Trend	N/A	N/A	N/A
Rotation Length	120 years implied for all pine species used by RCW	Same as 1/4 mile zone	Forest Plan Standards and Guidelines
Silvicultural Practices	Even-aged methods allowed to restore Pine Species desirable to RCW	Same as 1/4 mile zone plus expanded use of even-aged methods and use of irregular shelterwood to regenerate stands	Forest Plan Standards and Guidelines
Maximum Regeneration patch size	10 acres	Average or less 25 acres	Forest Plan Standards and Guidelines
Nesting Habitat Provisions	Extended Rotation, Replacement and Recruitment Stands, retention of relicts and other potential cavities trees	Same as 1/4 mile zone	None
Fragmentation Prevention	No regeneration harvest except to restore desirable pine species	Extended rotation, use of irregular shelterwood, patch size limitation	None
Prescribed Burning	Prescribed burning will be used extensively in both the 1/4 and 1/4-3/4 zones to control midstory vegetation.		Yes, but for objective other than RCW

PROTECTION OF CLUSTERS, REPLACEMENT, AND RECRUITMENT STANDS

The Forest Service proposes to incorporate the following standards and guidelines into the revised Handbook to ensure RCW clusters, replacement, and recruitment stands (described on page 46) are not adversely affected by other forest management activities.

Cutting

All alternatives would prohibit timber harvest, cutting or killing of trees within clusters, recruitment stands and replacement stands except where those actions would protect or improve RCW habitat. Snags or other dead trees would not be removed unless they posed a threat to public safety.

The alternatives would prohibit cutting of cavity trees in active and inactive clusters unless they posed a threat to public safety or to protect the cluster, recruitment stand, and replacement stand from insect attack. The Fish and Wildlife Service shall be consulted and shall issue a concurrence before any cavity tree would be cut.

Motorized, Heavy Equipment, And Concentrated Human Use Areas

This alternative requires habitat improvement projects involving motorized or heavy equipment to include sufficient project administration and/or contract language to protect the cluster, recruitment stand, and replacement stand, especially cavity trees and potential cavity trees.

This alternative would prohibit concentrated equipment use, such as log decks, pine straw bailing operations, off-road vehicle trails, trail heads, and campsites within clusters, recruitment stands and replacement stands.

The Forest Service will relocate or modify existing uses and activities if they are found to adversely affect the RCW.

Cavity Tree Protection During Prescribed Burning Operations

All alternatives encourage prescribed burning to control midstory vegetation for the benefit of the RCW, but require the burning prescription and cycles to minimize risk to cavity trees.

Cavity trees may be protected by raking away or back-burning adjacent fuels. Plow lines will be excluded from clusters unless needed to protect the cavity trees during an emergency.

Nesting Season Disturbance

All alternatives include some prohibition on activities that disturb RCWs during the nesting season, which generally runs from March 1 through July 31. The nesting season differs among different RCW groups and each year.

The nesting season begins with the start of courtship activities (preceding egg laying) and continues until young have left the nest and routinely accompany adults outside the cluster.

The Forest Service would require scheduling all potentially disturbing activities within the cluster before or after the nesting season. The general nesting season dates will be used unless the specific group's nesting season is documented and monitored to account for individual variation.

The Forest Service would also restrict its habitat improvement activities within clusters during the nesting season, unless such activity during the nesting season is necessary for the continued survival of the RCW group.

Construction Of Rights-of-Way

Alternative A would prohibit all construction of linear rights-of-way, such as roads, power lines, or pipelines within a cluster, recruitment stand, or replacement stand.

Existing Rights-of-Way Reconstruction and Maintenance

All alternatives would allow reconstruction or maintenance of existing roads through clusters, recruitment stands, and replacement stands if detailed study shows such activities will not adversely affect RCW and the activities are scheduled before or after the nesting season.

Road and rights-of-way reconstruction/maintenance through clusters will be closely monitored to ensure protection of cavity trees and potential cavity trees.

Southern Pine Beetle Suppression

The Forest Service will attempt to minimize the impact of southern pine beetle to cavity trees and foraging habitat. When RCW clusters, recruitment stands, and replacement stands are threatened by southern pine beetles, a biologist and entomologist would recommend a course of action before taking control measures.

The Southern Pine Beetle Record of Decision (USDA Forest Service, 1987, p. 33), sets standards and guidelines for protecting both cavity trees and the RCW during control operations as follows:

- Prohibits cutting of trees already vacated by beetles unless they pose a threat to public safety.
- Allows cutting of inactive or relict cavity trees, if infested or within a designated treatment buffer zone only to protect the rest of the cluster.
- Allows cutting of uninfested trees within 200 feet of a cavity tree only to protect cavity trees.
- Prohibits cut and remove operations during nesting season.
- Allows only minimal disturbance, such as cutting or chemical treatment, if necessary to protect the cavity trees during nesting season.
- Prohibits the use of the pile and burn control technique within clusters.

MANAGEMENT OF CLUSTERS, REPLACEMENT AND RECRUITMENT STANDS

The Forest Service proposes to actively manage the RCW clusters, recruitment stands, and replacement stands to ensure continued viability and population growth.

Marking Cavity Trees and Cluster Boundaries (Monumentation)

All alternatives require the marking of cavity trees to reduce the risk of accidental damage. The Forest Service needs to know where cavity trees are located on the ground to consistently apply protective standards and guidelines and monitor the cluster.

Alternative A requires that cluster boundaries be marked for easy recognition, but the marking may be temporary (signs) instead of permanent (paint). The marking of cavity trees and cluster boundaries must be updated when a project that would alter the habitat, such as timber harvest or road construction, is planned within 1/4 mile of a cluster (active and inactive).

Cluster Status - Data Base Management

All alternatives would recognize and require tracking of six cluster status categories (active, inactive, abandoned, historic, destroyed and invalid) which are defined in the glossary.

The Forest Service will maintain and update a database which includes status category of all RCW clusters within the HMAs. The database will link monitoring and survey data and show areas where replacement and recruitment stands are necessary.

Alternative A requires cavity trees to be preserved in all cluster categories, but special cluster management is not required for abandoned, destroyed, or invalid clusters unless identified as recruitment or replacement stands.

Changes in cluster status should be tracked and the database updated annually. Active clusters may be declared inactive if no RCW are living in them. Table 2-A3 shows when an inactive cluster may be declared abandoned if not identified as a replacement stand.

Table 2-A3
Abandoned Cluster Timetable
Inactive clusters in declining populations with fewer than 500 groups cannot be declared abandoned.

Population	Population Trend	Minimum Time (Years)
500	Regardless of Trend*	5
50-499	Stable or Increasing	10
1-49	Stable or Increasing	n/a
1-499	Decreasing	n/a

n/a: Cannot be abandoned

Recruitment Stands

Alternative A would establish recruitment stands in each compartment in which the population objective exceeds the current RCW population. The number of recruitment stands should equal the compartment population objective minus the number of existing groups in that compartment. The total of all compartment population objectives should equal the population objective for the population as a whole.

The selection criteria include:

- Nesting suitability considering stand age, forest type, and availability of relicts.

  The oldest available stands or younger stands with sufficient relicts should be selected. Inactive clusters may also be designated as recruitment stands. Midstory control should be completed and recruitment stands may be improved by installing artificial cavities.

- Distance to a cluster.

  Recruitment stands should lie within 1/4 mile to 3/4 mile from a cluster or other recruitment stands to ensure good spatial distribution and increase probability of colonization.

- Must have adequate suitable foraging habitat connected to the cluster or recruitment stand.

- Clusters in wilderness and on private land.

  Recruitment stands for RCW groups living in wildernesses should be located outside the wilderness boundary. This action would encourage the RCW population to extend itself away from the wilderness into an area where the clusters can be managed for its benefit.

  Recruitment stands should be established for RCW groups living on adjacent private lands within 3/4 mile of Forest Service System lands. These stands should be located on National Forest lands as close to the cluster as possible. This action would encourage the RCW to move Forest Service lands where cluster management can take place.

Replacement Stands

Alternative A would establish a replacement stand, for each nonwilderness and essential wilderness group. which are crucial for sustaining populations, for all active clusters. These stands would replace existing clusters as their cavity trees die.

The selection criteria include:

- Nesting suitability considering stand age, forest type, availability of relicts.

  Inactive clusters may be designated as replacement stands.

- Distance to a cluster.

  A replacement stand should be adjacent to the cluster if possible, and no more than 1/2 mile from it.

- Clusters in wilderness and on private land.

  Replacement stands for essential RCW groups living in wildernesses should be established as close to the cluster as possible, but located outside the wilderness boundary.

  Replacement stands would not be established adjacent to clusters on private lands until the group had moved onto Forest Service land.

Midstory Vegetation Control

Alternative A would require midstory removal and control be completed in all clusters, recruitment stands and replacement stands outside wilderness and should be completed for all essential wilderness groups.

The Forest Service will do midstory control over the entire stand, at least 10 acres for each cluster. The treatment should eliminate all hardwood midstory trees within a 50-foot radius of all active and inactive cavity trees. Total basal area of hardwoods should be less than 20 square feet.

Pine midstory should be controlled before the trees block access to cavity trees, potential cavity trees and line-of-sight between them. Evaluate the need to remove obstructing dominant and codominant pine and hardwood stems, within 50 feet of cavity and potential cavity trees.

Dominant and codominant hardwoods should be removed, unless a site-specific analysis indicates their removal would decrease the suitability of the stand for RCW. At no time should more than 20 square feet of basal area of dominant and codominant hardwoods be retained.

In areas where cluster, recruitment stand or replacement stand boundaries may include natural hardwood areas, such as stream bottoms, no treatment should occur to eliminate hardwoods or to control midstory within the natural hardwood area unless absolutely necessary to maintain the viability of the RCW group.

Outside clusters, but within the 3/4-mile radius circles, the reduction of hardwood midstory is encouraged in the pine and pine/hardwood forest types. The objective is improvement of foraging habitat. Prescribed burning will be the primary tool to accomplish this objective.

Prescribed burning is generally the best way to control midstory vegetation, especially small hardwoods. Burning regimes should mimic the naturally occurring fires which maintained these areas in pre-settlement times.

Emphasis should be placed on growing season burning, especially in those habitats which were naturally maintained by growing season fires: e.g., longleaf pine/wiregrass, longleaf pine/bluestem and shortleaf pine/bluestem. This would approximate natural conditions historically prevalent in these habitats. After midstory is controlled, burning during other seasons can be used infrequently.

The Forest Service will prioritize and schedule maintenance burns for those clusters, recruitment stands and replacement stands having already received initial treatment to eliminate midstory. Maintenance would receive priority to ensure that previous investments in initial midstory control are not wasted. See additional discussion on page 47.

Artificial Cavities

Artificial cavities and their role in the recovery of the RCW have been previously described on pages 47-51. The immediate objective in Alternative A will be to evaluate all RCW populations with fewer than 50 active clusters to determine the need for artificial cavities. The priorities previously listed for all alternatives will then be used to determine which clusters should be treated first. The long-term objective is evaluation and treatment of populations with more than 50 active clusters.

The Forest Service will use the procedures and methods specified by Taylor and Hooper (1991) and Allen (1991) to construct or install artificial cavities in suitable trees. Only individuals experienced in the respective techniques should install artificial cavities. Midstory vegetation must be controlled in conjunction with installation of artificial cavities. The Forest Service would prioritize and schedule installations to provide cavities where they are needed most.

The following priorities will be used:

(1) Active clusters with a single cavity tree.

(2) When needed to support translocation efforts.

(3) Active clusters with fewer than four usable cavities.

(4) Inactive clusters with fewer than four usable cavities within one mile of an active cluster.

(5) Recruitment stands within one mile of an active cluster.

(6) Inactive clusters with fewer than four usable cavities within three miles of an active cluster.

(7) Recruitment stands within three miles of an active cluster.

(8) Inactive clusters or recruitment stands more than three miles from an active cluster.

As the priorities imply, artificial cavities should first be installed in or very near active clusters and then progressively move to stands further away.

Reducing Cavity Competition

Cavity restrictors are metal plates with an oblong hole large enough for the RCW (generally 1-3/4" by 2-3/4" as shown in **Figure 2-3**). Cavity restrictors are placed around cavity entrances to prevent other birds (especially pileated and red-bellied woodpeckers) and mammals from enlarging them and displacing the RCW (Carter et al. 1989). Limited cavity availability in some areas has adversely affected the RCW. Cavity competition can be minimized by the following:

- Ensure that each group has at least four functional cavities through use of restrictors and/or artificial cavities.

- Maintain adequate levels of midstory control. This creates an unsuitable habitat condition for some cavity competitors.

- Install squirrel and snake excluder devices (non-lethal) as needed (Montague and Neal 1995, Withgott et al. 1995).

Cavity restrictors should be placed on enlarged RCW cavities and on unenlarged cavities where experience shows cavity enlargement is likely. The highest priority is active clusters which have a single cavity tree followed by single bird groups, then those clusters with 2 to 4 suitable cavities, and 5 to 8 cavities.

All artificial cavities should be fitted with restrictors when installed.

Restrictors should not be used on cavities which have been enlarged internally to the point of being unusable by RCW.

The Forest Service will monitor cavity restrictors to ensure proper installation and acceptance by the RCW.

Cavity restrictors and their role in the recovery of the RCW have been previously described on pages 51-52. The immediate objective in Alternative A will be to evaluate all RCW populations with fewer than 50 active clusters to determine the need for cavity restrictors. Any cluster with fewer than four usable cavities should have restrictors installed. The long-term objective is evaluation and treatment of populations with more than 50 active clusters.

Translocation

Translocation of RCW and its role in the recovery of the RCW have been previously described on pages 52-53.

The Forest Service will develop priorities and schedule translocation of RCW to best achieve the desired objectives. Priorities are usually based on the spatial distribution of existing groups and the probability of natural dispersal of juvenile RCWs being successful. Any single bird group could be a candidate for augmentation with a juvenile of the appropriate sex.

However, if a single bird group is more than a mile from another group containing a breeding pair, it would be a higher priority than a single bird group which had four or more breeding groups within the same mile distance. This is because the RCW in the second example has a much higher probability of receiving a new mate through natural dispersals than does the one which is far removed from a breeding group.

The priorities for reintroduction of RCW groups varies by management objective. If the technique is being used to expand an existing population, the priorities would be similar to those above for augmentation. It is also suggested this method not be used until all single bird groups in the population have been augmented.

If the management objective is the reestablishment of RCW into currently unoccupied habitat, those areas known to have held RCW since 1970 should be first priority.

The translocation of RCW within populations/subpopulations is encouraged. The short distances birds must be moved and the frequent similarity of the habitat may increase the probability of successful pairings. If translocations between populations are necessary, it is desirable to move birds between areas that are of similar latitude, elevation, and forest type.

The planned translocation of RCW will be required to maintain the genetic viability of populations with a reproducing population of less than 250. The effectiveness of such translocations will depend on the number of RCW moved to a specific population and the genetic makeup of these birds in relation to the receiving population. Such genetic exchanges can be through normal sub-adult augmentation.

The objective is to identify all single bird groups and move an appropriate sex juvenile bird to it, in an effort to create a breeding pair. Priority should be given to single bird groups in RCW populations with fewer than 50 active clusters.

HABITAT MANAGEMENT WITHIN 3/4 MILE CIRCLES

The following guides apply to the area within the 3/4-mile radius circles, but outside clusters, recruitment stands and replacement stands. These areas will be managed for a full range of multiple uses, but emphasize the production of foraging habitat and future nesting habitat (other than replacement and recruitment stands).

Prescribed Burning

The Forest Service should annually prescribe burn approximately 350,000 acres within 3/4 mile cirlces throughout the Region. The Forest Service would emphasize prescribed burning during the growing season, where appropriate. (See additional discussion on pages 53-54.)

Pine Restoration

The restoration of longleaf pine is an important element of Alternative A. See additional discussion on page 54.

The restoration of longleaf pine species is allowed, unless the stand in question is needed to provide foraging or nesting habitat for the RCW in the immediate future.

As important as restoring longleaf pine is to the long-term survival and recovery of the RCW, it is important to schedule pine restoration to minimize any age class bulges in the pine type age-class distribution. The Forest Service would base the rate for pine restoration on rotation and age-class distribution for the longleaf forest type. The forest type describes what species of tree is currently growing on the site.

When restoration is complete, all restored acres are calculated in the restored pine type age-class distribution. Alternative A would restrict the number of restoration acres in the 0 to 10 and 0 to 30 year age classes in the same manner as any other regeneration acres. For example: Alternative A implies a 120 year rotation for all pine species used by the RCW. This rotation would allow the harvest of 8.3 percent of the longleaf pine within the 3/4-mile radius circle each 10-year period. If more than 8.3 percent of the longleaf forest type is currently in the 0-10 age class no pine restoration could occur until these young stands grow older.

Regeneration patch size must be 25 acres or less. Six trees per acre and one acre or larger clumps of longleaf with 40 or more square feet of basal area, if available will be reserved as potential cavity trees.

Foraging Habitat Management

Alternative A would provide adequate foraging habitat as described on pages 54-56.

The Forest Service would evaluate foraging habitat within 1/2 mile of clusters and recruitment stands when pine tree removal is planned to ensure adequate foraging habitat is available after any harvest. Procedures described in the Fish and Wildlife Service Blue Book (USDI-Fish and Wildlife Service 1989) will be followed.

The Forest Service goal is to provide the highest quality foraging habitat as close as possible to RCW clusters and recruitment stands rather than large areas of poor habitat. Thinning within RCW foraging habitat should maintain at least a 70 square feet of pine basal area.

Where foraging habitat is limited, the Forest Service will prioritize thinning stands less than 10 inches in diameter within 1/2 mile of the cluster (closer to the cluster the better). Thinning helps trees grow faster and shortens the time required for these stands to become suitable foraging habitat. The Forest Service will use standard silvicultural prescriptions for thinning young stands.

The Forest Service must provide 100 percent of the foraging habitat equivalent for RCW groups whose 1/2 mile foraging zone extends onto another ownership (private, state, or other federal) without a cooperative agreement with the non-Forest Service landowner.

The Forest service will provide its proportional share of foraging for RCW groups on adjacent private, state, or other federal ownership but within 1/2 mile of National Forest land, if no cooperative agreement with the non-Forest Service landowner exist.

The cooperative RCW agreement is a contract that ensures adherence to the Fish and Wildlife Service foraging habitat procedures. This ensurance would allow foraging habitat equivalents to be shared in proportion to their availability between the Forest Service and adjacent landowner or agency.

Future Nesting Habitat

The provision of future nesting habitat is a key element of Alternative A (see pages 56-57).

Alternative A implies a rotation age which will produce numerous trees with the recommended heartwood at 32 feet, average cavity height (Clark 1992, Conner et al. 1994).

To provide future nesting habitat in the shortest period of time Alternative A, requires retention of the trees (by forest type) on the oldest third of existing acres within each 3/4-mile radius circle until they are within 10-20 years of rotation age, during the first rotation. For example, 240 acres of loblolly pine exist within the 3/4-mile radius circle. The oldest stands comprising 80 acres would not be regenerated until they were at least 100-110 years old. The first regeneration to occur in the oldest 1/3 should take place in the youngest of these stands.

Relict trees should not be removed during thinning operations unless they are spaced so closely that overall nesting habitat suitability is decreased. In such a situation, relicts should be thinned to a minimum spacing of 20-25 feet.

Thinning older stands or young stands with scattered relicts will increase their suitability as nesting habitat. Such thinnings can be used to stimulate colonization and promote population expansion. These thinned stands could also be used to lure RCW groups from a high risk or poor management situation into a location where their habitat can be managed. For example, an RCW group in wilderness or on private land could be lured into a 3/4 mile circle by improving potential nesting habitat along the wilderness or property boundary.

As forest stands approach the age to provide suitable nesting habitat, they should be managed to create the optimal stand structure which attracts colonizing RCW - an open, park-like stand with potential cavity trees free from obstruction by midstory or larger stems. These stands should be treated as if they were an RCW cluster. They should be thinned to maintain a pine basal area of 60 to 80 square feet and a minimum spacing of 20-25 feet between the dominant and codominant trees. The spacing is actually more critical than the basal area. However, if the trees in the stand are greater than 14 inches in diameter, the basal area guideline will provide adequate spacing.

Thinning

Thinning of forest stands is a key activity in the production of good RCW habitat and is an important element of Alternative A (see pages 57-59).

Thinning of older stands to enhance RCW habitat will vary depending on stand age. Stands between the ages of 30 and 70 will be managed primarily as foraging habitat.

Use the following guidelines:

- Maintain pine basal area of 60-110 square feet depending on site quality.

- If total pine basal area exceeds 100 square feet, do not remove more than 30 square feet of basal area in any single thinning operation.

- The priority for selecting pine trees to leave are:

  (1) relict trees
  (2) other potential cavity trees
  (3) trees greater than 10 inches diameter that are not potential cavity trees
  (4) trees less than 10 inches diameter

As stands become suitable as potential cavity trees, 70 years old and older, the following thinning guidelines will be used:

- Maintain pine basal area between 60 and 80 square feet.

- Ensure proper spacing to reduce southern pine beetle risk, 20-25 feet or more.

- Priority for selecting pine trees to remain are the same as above.

Regeneration and Sustaining RCW Habitat

Regeneration of new trees, individually or as stands, is needed to ensure an even and sustained flow of RCW habitat through time. Alternative A allows such regeneration (see additional discussion on pages 59-73).

The Forest Service would emphasize natural regeneration methods and prescribed fire as the primary seedbed preparation method, where site conditions allow. There are many PETS species found in the same habitats as the RCW. Site-specific biological evaluation and environmental accessments are designed to ensure PETS species are protected when vegetation management projects occur.

Alternative A will use a limited variety of forest regeneration methods. A 120-year rotation is implied for all pine species used by the RCW.

Within the 1/4-mile zone, the clearcutting method will usually be used to restore longleaf pine to sites currently occupied by other pine species. This is the only regeneration method allowed within the 1/4-mile zone.

Regeneration of forest stands is planned in the 1/4 - 3/4 mile zone with an even distribution of age classes as an objective. Emphasis is on providing potential nesting habitat on all sites. The Forest Service would use even-aged and two-aged regeneration methods.

- Clearcutting (even-aged) is limited to the regeneration of: Virginia and pitch pine, understocked or damaged stands, stands being restored to longleaf pine, and slash pine on wet sites.
- Irregular shelterwood (two-aged), which reserves the shelterwood trees for an indefinite period, is the primary harvest method in Alternative A.
- Regeneration patch size must average 25 acres, or less, within the 3/4-mile radius circles.

EVEN-AGED AND TWO-AGED SILVICULTURE

Alternative A implies a 120-year rotation for all pine species used by the RCW, based on the allowed regeneration of 8.3 percent of each forest type within the 3/4-mile radius circle each decade.

The Forest Service would calculate appropriate regeneration cutting within a 3/4-mile radius circle based on:

- The acres of suitable RCW habitat (pine and pine-hardwood forest types with the potential to produce suitable foraging habitat) within the 3/4-mile radius circle that are identified as suitable for timber management (Land Class Codes 500 and 600).
- The rotation that is applied to each forest type represented.
- The existing acreage of each forest type which is in the 0-10 and 0-30 age classes.
- Additional mitigation measures which are identified and discussed in the following sections of various harvest methods.

The Forest Service must consider the effects of catastrophic impacts from insect, disease, fire, or weather, when considering age-class distribution calculations for planned regeneration. For example, if a wind storm destroyed 200 acres of pine type within the 3/4-mile radius circle, that acreage must be included in the 0 to 10 age class, which reduces the acreage available for commercial harvest. All temporary openings less than 10 acres, such as cuttings to control southern pine beetle must also be included in the 0-10 or appropriate age class.

Even-Aged Silviculture - Clearcut

Alternative A would restrict clearcutting within 3/4-mile radius circles to specific situations. The use of clearcutting also varies within the management intensity zones. A site specific analysis must show a definite long-term benefit and no short-term adverse effects on RCW.

The site specific analysis must show:

- Sufficient foraging habitat is available after harvest for each cluster and recruitment stand.
- Foraging habitat is not fragmented by proposed cutting, but is continuous and contiguous with the cluster, recruitment stand or replacement stands.
- Replacement and recruitment stands are not isolated from respective cluster(s) and adjacent clusters are not isolated from each other by regeneration areas or natural habitat barriers.
- The distribution of age classes should ensure an even flow of habitat is available through time.

These requirements and limitations must be met before clearcutting can occur.

Clearcutting method would be allowed only to regenerate forest stands in specific situations. The Forest Service must study each site to determine whether clearcutting and planting are the optimal means of regenerating RCW habitat.

The four situations that likely would meet the silvicultural criteria are:

(1) Virginia and pitch pine stands.

The silvical characteristics of Virginia pine and pitch pine make clearcutting the only practical method of regenerating the stand. Virginia pine is shallow rooted, short lived, and blows down easily if the stand is opened up. Pitch pine forms branches all along the stem when grown in the open making the tree unsuitable for RCWs. Both species are intolerant of shading and grow well in full sunlight. Use of clearcutting to regenerate Virginia and pitch pine is not allowed in the 1/4-mile zone.

(2) Wet site slash pine.

Slash pine sites which are poorly drained or very wet where high water tables restrict seedling survival and growth can be regenerated by clearcutting only in the 1/4-3/4 mile zone. Retain six potential cavity trees and or relicts (first priority) per acre. The distribution of the potential cavity trees should not be evenly distributed across the regeneration unit, but in clumps.

(3) Understocked or damaged stands.

Natural regeneration is difficult to achieve in understocked or damaged stands; planting and/or seeding may be necessary. Uneven distribution and low basal area are typical for these stands.

The Forest Service may clearcut these stands, in the 1/4-3/4 mile zone, if they have fewer than 24 trees 10 inches DBH or larger. Reserve any one acre or larger clumps of pine with 40 square feet or more basal area and 6 potential cavity trees per acre.

The Forest Service will prioritize these potential cavity trees in all areas to be clearcut, reserving relicts first. The reserved trees may be clumped, scattered or a combination of clumped and scattered.

(4) Pine restoration sites.

The Forest Service may also clearcut stands of off sites species which are not understocked or damaged to restore longleaf pine. Pine restoration is the only regeneration harvest allowed in the 1/4-mile zone and is described in detail on pages 54 and 88. Patch size must average 25 acres or less. Where available, six longleaf relicts per acre and any one acre or larger clumps of longleaf with 40 or more square feet of basal area must be reserved to provide potential cavity trees in the near future. Relict trees would be reserved in clumps, scattered or a mixture depending on site conditions.

Even-Aged Silviculture - Seed-tree and Shelterwood

These methods will not be used in the 3/4-mile radius circle.

Two-Aged Silviculture - Irregular Shelterwood

Within 1/4 mile of the cluster this method will not be used.

In the area between 1/4 and 3/4 mile of clusters irregular shelterwood will be the primary regeneration method. Any time regeneration is considered, a site specific analysis must show definite long-term benefits and no short-term adverse effects toward the RCW.

Irregular shelterwood involves one or more removals, but leaves all or part of the seed trees standing indefinitely. This method is suitable for all forest types except Virginia pine, pitch pine, and longleaf pine. A two-aged stand may be produced. In addition, the seed trees in existing shelterwood or seed-tree regeneration areas would not be removed, in either management zone.

The analysis must show:

- Sufficient foraging habitat is available after harvest for each cluster, recruitment stand and replacement stand.
- Foraging habitat is not fragmented by proposed cutting, but is continuous and contiguous with the cluster, recruitment stand, and replacement stand.

- o Replacement and recruitment stands are not isolated from respective cluster(s) and adjacent clusters are not isolated from each other by proposed regeneration areas.

- o The distribution of age classes should ensure an even flow of habitat is available through time.

In addition, specific guidelines for considering regeneration between 1/4 and 3/4 mile of a cluster are provided to ensure desired age class distribution within this area and maintenance or enhancement of existing suitable habitat.

They are:

- No regeneration in the oldest 1/3 of suitable habitat within 3/4 mile of the cluster until these stands approach rotation age (120 years), through the first rotation.

- If possible, regenerate in the predominant age class and not necessarily the oldest.

- No regeneration if more than 25 percent of suitable habitat within 3/4 mile of the cluster is less than 30 years old.

- No regeneration if more than 8.3 percent of suitable habitat within 3/4 mile of the cluster is 10 years old or less including non-stand size openings due to insects, disease or other resource management activities.

  If the above criteria are met and the irregular shelterwood regeneration method is considered, the minimum leave basal area to be left for loblolly and shortleaf pine is 30 square feet per acre and 25-40 square feet per acre for longleaf and slash pine.

  Relict trees, potential cavity trees, and trees 10 inches in diameter or larger meeting seed tree requirements should be selected in that order for retention in regeneration areas. The seed trees would remain indefinitely.

UNEVEN-AGED SILVICULTURE

Uneven-aged regeneration methods (group and single-tree selection) are not a management option in Alternative A.

MONITORING

Monitoring will occur at sufficient intensity to assess accomplishment of the alternative objectives of stabilizing RCW population declines and achieving long-term recovery. An RCW cluster status and management needs data base will be established to track cluster status survey results. This system would have sufficient information to track group status, cavity use, habitat improvement, treatment accomplishments and needs, cluster habitat conditions, and survey status.

The data base would be used to help set treatment priorities, report accomplishments, identify population trends, and describe response to treatments.

Generally, larger populations need less intensive monitoring requirements. Once this monitoring strategy is in place, it would be possible to (1) determine population trends on an annual basis through sequentially observed periodic surveys of compartments (Hooper and Muse 1989), (2) know where all groups are located, (3) describe extent of single bird groups, (4) ensure protection and management of priority groups, and (5) determine effective population size.

Monitoring of RCW will consist of two primary techniques. Visiting active clusters on a periodic basis to determine the presence and number of birds at the site is called a cluster check. If determining the presence of young RCW is an objective, these checks must occur during the nesting season. The frequency of cluster checks will vary by population size.

Cluster location surveys involve the systematic searching of all suitable RCW nesting habitat to locate all clusters. Suitable nesting habitat includes pine and pine/hardwood (excluding white and sand pine) stands 60 years or older (50 years or older in Virginia pine), or any other stand with sufficient older aged pines to support a cluster. The survey methodology must ensure that no cluster is likely to be missed. The time frame to survey all suitable nesting habitat varies by population size.

Monitoring of Populations with Less than 100 Active Clusters

Check all known clusters (active and inactive) annually.

Complete cluster location surveys of all suitable RCW nesting habitat within each compartment designated for silvicultural inventory and evaluation each year until all suitable nesting habitat on the Forest Service unit has been surveyed. In addition, complete a cluster location survey of the suitable nesting habitat within 1500 feet of inactive clusters which were active the previous year.

Include the findings for these checks and surveys in the RCW data base.

Monitoring of Populations with 100 to 250 Active Clusters

Check all active, recently active (was active in past two years) and inactive clusters that are within three miles of an active cluster annually.

Complete cluster location surveys of all suitable RCW nesting habitat within each compartment designated for silvicultural inventory and evaluation each year until all suitable nesting habitat on the Forest Service unit has been surveyed. In addition, complete a cluster location survey of the suitable nesting habitat within 1500 feet of inactive clusters which were active the previous year.

Complete a resurvey of the 1980-82 baseline compartments as soon as possible, using the same basic techniques used in the original survey. This survey should be completed on a 10-year cycle to develop 10-year trend data.

Include the findings from these checks and surveys in the RCW data base.

Monitoring of Populations with Over 250 Active Clusters

Check all clusters that are in compartments where silvicultural inventory and evaluations are being conducted and/or are within 3/4 mile of proposed projects that could affect RCW. While conducting cluster checks determine priorities for RCW management activities.

Complete cluster location surveys of all suitable RCW nesting habitat within each compartment designated for silvicultural inventory and evaluation each year until all suitable nesting habitat on the Forest Service unit has been surveyed. In addition, complete a cluster location survey of the suitable nesting habitat within 1500 feet of inactive clusters which were active the previous year.

Complete a resurvey of the 1980-82 baseline compartments as soon as possible, using the same basic techniques used in the original survey. This survey should be completed on a 10-year cycle to develop 10-year trend data.

Include the findings from these checks and surveys in the RCW data base.

SOUTHERN PINE BEETLE HAZARD REDUCTION

Alternative A recommends that thinnings be used to maintain tree vigor and reduce southern pine beetle risk. The Forest Service would thin stands where southern pine beetle hazard was high to achieve a minimum 20-25 feet spacing between trees, but maintain an overstory pine basal area of at least 70 square feet per acre. Alternative A would follow the standard Southern Region thinning guides (Appendix E) except for RCW leave tree selection criteria. The Regional thinning guides recommend a range of 60 to 110 square feet of residual pine basal area, depending on site and stand conditions and the availability of RCW foraging habitat.

Detailed methods to reduce a southern pine beetle hazard is described in "Managing Southern Forests to Reduce Southern Pine Beetle Impacts," (USDA-Southern Region, 1986).

HABITAT FRAGMENTATION CONTROL

No specific criteria are identified to control habitat fragmentation. However, the harvest restrictions in the 1/4-mile radius circle, the high leave basal areas required with the irregular shelterwood method, the retention of relicts and other inclusions in other regeneration areas and the reduced regeneration patch size is intended to minimize potential habitat fragmentation.

CLEARING FOR NON-TIMBER MANAGEMENT PURPOSES

The removal or clearing of forest cover for oil/gas exploration, developed recreation sites, creating a lake, etc., may create a permanent loss of RCW habitat. The Forest Service would evaluate all proposed clearings within 3/4-mile radius circles and determine whether they would impact the RCW.

Within 1/4 mile of active and inactive clusters, clearing 10 acres or less for non-timber management purposes would not occur if one or both of the following conditions exist. Clearings greater than 10 acres would not be considered.

(1) More than 25 percent of suitable habitat within 1/4 mile of the cluster is less than 30 years of age.

(2) 8.5 percent of suitable habitat within 1/4 mile of the cluster is 10 years old or less including all non-stand size temporary openings due to insects, disease, or other resource management activities.

Between 1/4 and 3/4 mile of clusters, clearings less than 10 acres could occur but not in the oldest 1/3 of the existing suitable habitat.

If a clearing greater than 10 acres is considered within suitable habitat it could occur if it doesn't affect the oldest 1/3 of existing suitable habitat, and consideration is be given to the potential adverse effects of habitat fragmentation, cluster isolation, foraging habitat amounts and continuity, recruitment and replacement stand isolation and age-class distribution imbalances.

Alternative B

SUMMARY - ALTERNATIVE B

Alternative B is based on the 1985 Handbook, with modifications to include information which has become available since 1985. RCW management is concentrated on clusters, replacement, and recruitment stands. The area outside these stands would be managed using Forest Plan standards and guidelines.

This alternative would set into motion an immediate and deferred set of actions, each containing various elements. These actions are described in detail in this chapter. The current conditions affecting the RCW and environmental effects are described in Chapter 3.

REVISED HANDBOOK

The Forest Service proposes to revise the Regional Wildlife Habitat Management Handbook, FSH 2609.23R (Handbook) and the Southern Regional Guide to incorporate the revised Handbook immediately after the Record of Decision (ROD). The revised Handbook would make the Handbook consistent with decisions made since 1985, such as the Fish and Wildlife Service's "Blue Book" and the southern pine beetle Record of Decision.

Elements of the Proposed Handbook Revision

Alternative B would:

(1) Establish Regional Handbook direction for management of the red-cockaded woodpecker and its habitat.

- Emphasize the use of artificial cavities and the moving of RCW from area to area (translocation) to speed population expansion and eventual recovery of the species.
- Replace the delineated 3/4-mile radius circles around all active and inactive RCW clusters (colony sites) with the cluster boundaries and establish recovery population objectives to comply with the 1985 RCW Recovery Plan.
- Establish sufficient recruitment stands to meet population objectives.
- Utilize a wide range of regeneration methods outside the clusters, recruitment stands, and replacement stands, with silvicultural objectives taking precedence within the confines of multiple use.
- Rotations would be governed by the Forest Plans outside cluster, recruitment stands and replacement stands.
- Emphasize thinning to reduce southern pine beetle risk and enhance RCW foraging habitat.
- Emphasize prescribed fire to control midstory vegetation in the pine and pine-hardwood forest types within clusters, recruitment stands, and replacement stands.

- o Assure adequate foraging habitat (6350 pine trees greater than 10" diameter, 30 years old or older within 1/2 mile of and connected to the clusters).

- o Allow restoration of longleaf and other desirable pine species in areas where they occurred historically and would provide better habitat for the RCW.

(2) Establish monitoring requirements to determine if the objectives of the new RCW management direction are being met.

IMMEDIATE ACTIONS

The Forest Service would continue to manage the national forests where the RCW lives under the Interim policy described briefly in Chapter 1. Interim would affect management within the 3/4-mile radius circles surrounding the red-cockaded woodpecker's cavity trees until the Forest Land and Resources Management Plans (Forest Plans) are revised or amended. The areas outside the 3/4-mile radius circles would be managed under current Forest Plans.

DETAILED DESCRIPTION - ALTERNATIVE B

Habitat Management Areas

Alternative B does not have clearly defined habitat management areas. Management emphasis is placed on the individual clusters, replacement and recruitment stands, and associated foraging habitat. In order to meet the new population objectives established below, additional recruitment stands and associated foraging habitat must be designated. The number of new recruitment stands needed will be the Forest Service unit population objective less the number of existing active clusters and current recruitment stands. Replacement stands will be established for active clusters.

The unit population objective will be broken down by management compartment. It is very difficult to estimate the total acreage which will be devoted to RCW management as foraging habitat is now based on number of available pine trees instead of acres. There will be approximately 124,500 acres associated with clusters, recruitment stands, and replacement stands.

Setting Population Objectives

The 1985 Handbook established population objectives for all known RCW populations on National Forest System lands. Total population objectives are broken down and assigned by compartment. The Handbook population objectives have been modified to meet RCW recovery objectives as described in the RCW Recovery Plan. Recovery population objectives have been increased to the 250 actively breeding pairs or 500 total active clusters as agreed on at the RCW Summit, or the maximum number of groups the land base will support as defined in Appendix A. Support population objectives will remain the same as identified in the Handbook. Table 2-B1 shows the population objectives associated with this alternative.

Table 2-B1
Tentative Population Objective.
Tentative population objectives are a modification of those described in the Handbook.

STATE	National Forests/ District (RECOVERY POP. UND)	Population 1994	Tentative Pop. Objective
		(Active Clusters)	
ALABAMA	Bankhead	0	50
	Conecuh	14	309
	Oakmulgee RD	120	394
	Talladega/Shoal Creek RDs	5	500
		138	1,253
ARKANSAS	Ouachita	15	50
FLORIDA	Apalachicola	650	826
	Ocala	4	125
	Osceola	45	490
		699	1,441
GEORGIA	Oconee/Hitchiti *	16	176*
KENTUCKY	Daniel Boone	3	50
LOUISIANA	Kisatchie-		
	Catahoula/Winn RDs	45	125
	Evangeline RD	52	70
	Kisatchie RD	69	100
	Vernon RD	186	321
		352	616
MISSISSIPPI	Bienville	92	500
	DeSoto	10	500
	Homochitto	27	125
		129	1,125
N.CAROLINA	Croatan	55	139
S.CAROLINA	Francis Marion	371	500
TENNESSEE	Cherokee	1	n/a
TEXAS	Angelina/Sabine	42	250
	Davy Crockett	38	125
	Sam Houston*	149	500
		229	875
SOUTHERN REGION		2,008	6,225

* The Oconee NF is combined with Hitchiti Experimental Forest and Piedmont National Wildlife Refuge by Memorandum of Understanding (FSM 2609.23). The figures listed, however, show only the Forest Service population objectives.

Management Intensity Levels

Alternative B does not have different management intensity levels. The same degree of management intensity is applied to all RCW clusters, recruitment stands replacement stands, and associated habitat.

Establishment of Subhabitat Management Areas

The establishment of subhabitat management areas is not a management option in Alternative B as habitat management areas are not designated.

PROTECTION OF CLUSTERS, REPLACEMENT, AND RECRUITMENT STANDS

The Forest Service proposes to incorporate the following standards and guidelines into the revised Handbook to ensure that RCW clusters, recruitment stands, and replacement stands (described on pg. 46) are not adversely affected by other forest management activities.

Cutting

All alternatives would prohibit timber harvest, cutting or killing of trees within clusters, recruitment stands and replacement stands except where those actions would protect or improve RCW habitat. Snags or other dead trees would not be removed unless they posed a threat to public safety.

The alternatives would prohibit cutting of cavity trees in active and inactive clusters unless they posed a threat to public safety or to protect the cluster, recruitment stand, and replacement stand from insect attack. The Fish and Wildlife Service shall be consulted and shall issue a concurrence before any cavity tree would be cut.

In addition, do not issue firewood permits in clusters.

Motorized, Heavy Equipment, And Concentrated Human Use Areas

In RCW populations with fewer than 50 active clusters Alternative B prohibits projects involving motorized or heavy equipment during the nesting season (March-July).

In populations with 50 or more active clusters, Alternative B requires such projects to be minimized during the nesting season.

Concentrated equipment or human use such as log decks, pine straw bailing operations, and new off-road vehicle trails, are not prohibited within clusters, recruitment stands and replacement stands but project planning should locate such activities outside these areas, if possible.

Cavity Tree Protection During Prescribed Burning Operations

All alternatives encourage prescribed burning to control midstory vegetation for the benefit of the RCW but require the burning prescription and cycles to minimize risk to cavity trees.

Cavity trees may be protected by raking away or back-burning adjacent fuels. Plow lines will be excluded from clusters unless needed to protect the cavity trees during an emergency.

Nesting Season Disturbance

Alternative B would prohibit activities that disturb RCWs during March, April, May, June, and July in populations with fewer than 50 active clusters.

In populations with 50 or more active clusters, such activities would be minimized during this time period.

The Forest Service will restrict its habitat improvement activities within clusters during March-July, unless such activity during this period is necessary for the continued survival of the RCW group.

Construction Of Rights-of-Way

Alternative B would allow construction of linear rights-of-way, such as roads, power lines, or pipelines within clusters, recruitment stands, and replacement stands if the construction takes place outside the months of March-July. There must be adequate contract language and administration to protect cavity trees.

Existing Rights-of-Way Reconstruction/Maintenance

Alternative B would allow reconstruction/heavy maintenance of existing roads through clusters, recruitment stands, and replacement stands. Road and rights-of-way reconstruction/maintenance through clusters will be closely monitored to ensure protection of cavity trees and would take place before or after the nesting season.

Southern Pine Beetle Suppression

The Forest Service will attempt to minimize the impact of southern pine beetle to cavity trees and foraging habitat. When RCW clusters, recruitment stands, and replacement stands are threatened by southern pine beetles, a biologist and entomologist would recommend a course of action before taking control measures.

The Southern Pine Beetle Record of Decision (USDA Forest Service, 1987, p. 33), sets standards and guidelines for protecting both cavity trees and the RCW during control operations as follows:

- Prohibits cutting of trees already vacated by beetles unless they pose a threat to public safety.
- Allows cutting of inactive and relict cavity trees, if infested or within a designated treatment buffer zone only to protect the rest of the cluster.

- Allows cutting of uninfested trees within 200 feet of a cavity tree only to protect cavity trees.

- Prohibits cut and remove operations during nesting season.

- Allows only minimal disturbance, such as cutting or chemical treatment, if necessary to protect the cavity trees during nesting season.

- Prohibits the use of the pile and burn control technique within clusters.

Alternative B considers wilderness RCW groups essential to recovery. As such, southern pine beetle control will occur in wildernesses to protect these groups as discussed in the Final Environmental Impact Statement for the Suppression of the Southern Pine Beetle, following the criteria established in the Record of Decision for that document (USDA Forest Service 1987). The Record of Decision stated only essential groups and their foraging habitat would be protected. The criteria that triggers initiation of control action are the southern pine beetle infestation must be within 1/2 mile of an essential group, adverse effects are likely to occur within the next 30 days, and the continued existence of the group is in question.

MANAGEMENT OF CLUSTERS, REPLACEMENT, AND RECRUITMENT STANDS

The Forest Service proposes to actively manage the RCW clusters, recruitment stands and replacement stands to ensure continued viability and population growth.

Marking Cavity Trees and Cluster Boundaries (Monumentation)

All alternatives require the marking of cavity trees to reduce the risk of accidental damage. The Forest Service needs to know where the cavity trees are located on the ground to consistently apply the protective standards and guidelines and monitor the cluster.

Alternative B requires the marking of all cavity trees (active and inactive) with paint and metal ID tags. Because cluster boundaries change, it is recommended they not be marked with paint. Temporary markings such as plastic signs or flagging tape may be used.

All clusters, recruitment stands, and replacement stands should be identified as a stand in compartment records and maps.

Cluster Status - Data Base Management

All alternatives would recognize and require tracking of six cluster status categories (active, inactive, abandoned, historic, destroyed, and invalid) which are defined in the glossary.

The Forest Service will maintain and update a data base which includes status category of all RCW clusters within the HMAs. The data base will link monitoring and survey data and show areas where replacement and recruitment stands are necessary.

Cavity trees will be preserved in all cluster categories except invalid. Special cluster management is not required for abandoned, historic, or destroyed. Clusters, unless identified as recruitment or replacement stands.

Changes in cluster status should be tracked and the data base updated annually. Active clusters may be declared inactive if no RCWs are living in them. Inactive cluster may be declared abandoned after 5-10 years of inactivity if not identified as a recruitment or replacement stand. The cluster must be evaluated by a wildlife biologist prior to abandonment and all cavity trees must be retained.

Recruitment Stands

Alternative B will establish recruitment stands in each compartment where the population objective exceeds the current RCW population. The number of recruitment stands should equal the compartment objective minus the number of groups in that compartment.

Recruitment stands are not required if the rotation age is at least 100 years for longleaf and 80 years for other southern yellow pines (loblolly, slash, shortleaf, etc.) in compartments containing active clusters.

Replacement Stands

Alternative B would establish replacement stands, in compartments containing active clusters if rotation age for longleaf is 80 years and other southern yellow pines (loblolly, slash, shortleaf, etc.) is 70 years.

Replacement stands are not required if the rotation age is at least 100 years for longleaf and 80 years for other southern yellow pines.

Midstory Vegetation Control

Alternative B would require midstory removal and control be completed in clusters, recruitment stands and replacement stands. RCWs typically abandon their nests when adjacent midstory trees grow taller than the cavity.

The Forest Service will do midstory control over the entire stand, at least 10 acres for each cluster. The treatment should eliminate all hardwood midstory trees within a 50-foot radius of all active and inactive cavity trees. Total basal area of hardwoods should be less than 20 square feet.

Pine midstory should be controlled before the trees block access to cavity trees, potential cavity trees and line-of-sight between them. Evaluate the need to remove obstructing dominant and codominant pine and hardwood stems, within 50 feet of cavity and potential cavity trees. See additional discussion on page 47.

Artificial Cavities

Artificial cavities and their role in the recovery of the RCW have been previously described on pages 47-51. The immediate objective in Alternative B will be to evaluate all RCW populations with fewer than 50 active clusters to determine the need for artificial cavities. The priorities previously listed for all alternatives will then be used to determine which clusters should be treated first. The long-term objective is evaluation and treatment of populations with more than 50 active clusters.

The Forest Service will use the procedures and methods specified by Taylor and Hooper (1991) and Allen (1991) to construct or install artificial cavities in suitable trees. Only individuals experienced in the respective techniques should install artificial cavities. Midstory vegetation must be controlled in conjunction with installation of artificial cavities. The Forest Service would prioritize and schedule installations to provide cavities where they are needed most.

The following priorities will be used:

(1) Active clusters with a single cavity tree.

(2) When needed to support translocation efforts.

(3) Active clusters with fewer than four usable cavities.

(4) Inactive clusters with fewer than four usable cavities within one mile of an active cluster.

(5) Recruitment stands within one mile of an active cluster.

(6) Inactive clusters with fewer than four usable cavities within three miles of an active cluster.

(7) Recruitment stands within three miles of an active cluster.

(8) Inactive clusters or recruitment stands more than three miles from an active cluster.

As the priorities imply, artificial cavities should first be installed in or very near active clusters and then progressively move to stands further away.

Reducing Cavity Competition

Cavity restrictors are metal plates with an oblong hole large enough for the RCW (generally 1-3/4" by 2-3/4" as shown in **Figure 2-3**). Cavity restrictors are placed around cavity entrances to prevent other birds (especially pileated and red-bellied woodpeckers) and mammals from enlarging them and displacing the RCW (Carter et al. 1989). Limited cavity availability in some areas, has adversely affected the RCW. Cavity competition can be minimized by the following:

- Ensure that each group has at least four functional cavities through use of restrictors and/or artificial cavities.

- Maintain adequate levels of midstory control. This creates an unsuitable habitat condition for some cavity competitors.

- Install squirrel and snake excluder (non-lethal) devices as needed (Montague and Neal 1995, Withgott et al. 1995).

Cavity restrictors should be placed on enlarged RCW cavities and on unenlarged cavities where experience shows cavity enlargement is likely. The highest priority is active clusters which have a single cavity tree followed by single bird groups, then those clusters with 2 to 4 suitable cavities, and 5 to 8 cavities.

All artificial cavities should be fitted with restrictors when installed.

Restrictors should not be used on cavities which have been enlarged internally to the point of being unusable by RCW.

The Forest Service will monitor cavity restrictors to ensure proper installation and acceptance by the RCW.

Cavity restrictors and their role in the recovery of the RCW have been previously described on pages 51-52. The immediate objective in Alternative B will be to evaluate all RCW populations with fewer than 50 active clusters to determine the need for cavity restrictors. Any cluster with fewer than four usable cavities should have restrictors installed. The long-term objective is evaluation and treatment of populations with more than 50 active clusters.

Translocation

Translocation of RCW and its role in the recovery of the RCW have been previously described on pages 52-53.

The Forest Service will develop priorities and schedule translocation of RCW to best achieve the desired objectives. Priorities are usually based on the spatial distribution of existing groups and the probability of natural dispersal of juvenile RCWs being successful. Any single bird group could be a candidate for augmentation with a juvenile of the appropriate sex.

However, if a single bird group is more than a mile from another group containing a breeding pair, it would be a higher priority than a single bird group which had four or more breeding groups within the same mile distance. This is because the RCW in the second example has a much higher probability of receiving a new mate through natural dispersals than does the one which is far removed from a breeding group.

The priorities for reintroduction of RCW groups varies by management objective. If the technique is being used to expand an existing population, the priorities would be similar to those above for augmentation. It is also suggested this method not be used until all single bird groups in the population have been augmented.

If the management objective is the reestablishment of RCW into currently unoccupied habitat, those areas known to have held RCW since 1970 should be first priority.

The translocation of RCW within populations/subpopulations is encouraged. The short distances birds must be moved and the frequent similarity of the habitat may increase the probability of successful pairings. If translocations between populations are necessary, it is desirable to move birds between areas that are of similar latitude, elevation, and forest type.

The planned translocation of RCW will be required to maintain the genetic viability of populations with a reproducing population of less than 250. The effectiveness of such translocations will depend on the number of RCW moved to a specific population and the genetic makeup of these birds in relation to the receiving population. Such genetic exchanges can be through normal sub-adult augmentation.

The objective is to identify all single bird groups and move an appropriate sex juvenile bird to it, in an effort to create a breeding pair. Priority should be given to single bird groups in RCW populations with fewer than 50 active clusters.

HABITAT MANAGEMENT OUTSIDE CLUSTERS

The following guides apply to forest management activities within the general forest area of compartments which have RCW or RCW population objectives. Management emphasis would be the production of foraging habitat using standard silvicultural practice. This area will be managed for a full range of multiple uses.

Prescribed Burning

Prescribed burning on a two- to five-year cycle will be used to control midstory and reduce fire hazard, primarily within clusters, replacement stands, and recruitment stands. Burning may be applied in other stands where the trees are large enough to escape damage by the fire, however, the objective is usually other than RCW habitat improvement. Specific frequency, season, and prescription for burning in any area would vary, depending upon the vegetation, site and weather conditions, and the RCW management priorities. See additional discussion on pages 53-54.

Pine Restoration

The restoration of longleaf, shortleaf or other desirable pine species to sites originally occupied by these species to improve RCW habitat is desirable. Restoration of desirable pine species will be allowed, as part of normal forest management, assuming criteria to provide adequate foraging are met. See additional discussion on page 54.

Foraging Habitat Management

The Forest Service would evaluate foraging habitat within 1/2 mile of clusters and recruitment stands when pine tree removal is planned to ensure adequate foraging habitat is available after any harvest. Procedures described in the Fish and Wildlife Service Blue Book (USDI Fish and Wildlife Service 1989) will be followed.

Prior to 1989, suitable foraging habitat in the Handbook was defined as 125 acres or more of well stocked (60-90 square feet per acre of basal area) pine or pine-hardwood stands which are 30 years or older (40 percent or 50 acres $\geq$ 60 years old) contiguous to the cluster. As an option, a Forest could provide an equivalent foraging amount of 6350 pine trees $\geq$ 10 inches in diameter.

However, with issuance of the Blue Book by the U.S. Fish and Wildlife Service (USDI Fish and Wildlife Service 1989). It became mandatory to calculate foraging based on the number of suitable foraging stems and an adequate amount of pine basal area within a 1/2-mile radius of the cluster.

Alternative B will provide foraging habitat as described on pages 54-56.

Future Nesting Habitat

Alternative B requires management for future nesting habitat only in designated clusters, recruitment stands, and replacement stands.

Thinning

In Alternative B foraging habitat analysis must be completed before thinnings could take place in pine or pine-hardwood stands 30 years old or older within 1/2-mile of clusters or recruitment stands. Thinnings should not take place if foraging habitat is limiting (see pages 57-59).

Where foraging habitat equivalents are not limiting, thin pine and pine-hardwood stands (except Virginia and sand pine) where feasible to (1) reduce the risk of southern pine beetle infestation by increasing tree vigor or (2) improve RCW habitat. Do not thin to less than 60 pine basal area. Standard Forest Service Region 8 silvicultural thinning guidelines apply. (See Appendix E for the guidelines).

In stands not considered suitable as foraging habitat (10 inch diameter or smaller) thinning is encouraged and can take place at any time. Standard silvicultural thinning guidelines will apply (see Appendix E).

Regeneration and Sustaining RCW Habitat

- Diameter limits to determine which trees should be harvested in stands managed with uneven-aged methods (single or group selection) are based on a desired forest product such as an 18 inch saw log.

  Alternative B uses standard regeneration, site preparation, seeding, and planting methods in the general forest area.

  The Forest Service would use both even aged, two-aged, and uneven-aged regeneration methods, as specified in individual forest plans (see pages 59-73).

- Clearcutting would be utilized as a regeneration method, as identified in Forest Plans and with the Chief's June 25, 1992 letter on ecosystem management.

- Seed-tree, shelterwood and irregular shelterwood may be used more frequently if clearcutting is limited.

- Uneven-aged methods, group and single-tree selection, may be used as specified in individual forest plans.

- Regeneration patch size will be controlled by individual forest plan standards and guidelines.

EVEN-AGED AND TWO-AGED SILVICULTURE

Table 2-B2 shows minimum rotation ages prescribed in Alternative B, and the amount of land which can be sustainable regenerated per decade. Rotation ages for pine-hardwood forest types would be set by the pine species present.

Table 2-B2
Percentage of Area to Harvest by Forest Type and Rotation Length.
The area to be regenerated in any decade decreases as the rotation age increases.

Forest Type	Rotation	Percentage of Area to Regenerate in 10 Yr Period
With Replacement Stands:		
Longleaf pine	80 years	12.5%
Other Yellow pines	70 years	14.3%
Without Replacement Stands:		
Longleaf pine	100 years	10.0%
Other Yellow pines	80 years	12.5%

The Forest Service would calculate appropriate regeneration acres based on the following criteria:

- The acres within an area that are identified as suitable for timber management (Land Class Codes 500 and 600).

- The rotation that is applied to each forest type represented.

- The availability of RCW foraging habitat.

- Additional mitigation measures which are identified and discussed in the following sections on the various harvest methods.

Even-aged Silviculture - Clearcut

Alternative B would allow clearcutting as a regeneration method if allowed in individual Forest Plans (see pages 64-65). Clearcutting may occur if a site specific study shows that:

- o Sufficient foraging habitat would be available after harvest for each cluster and recruitment stand.
- o Foraging habitat continuous and contiguous with clusters, recruitment stands and replacement stands producing trees can be removed.

Even-aged Silviculture - Seedtree and Shelterwood

Alternative B would permit using seedtree and shelterwood regeneration methods within compartments occupied by RCW where allowed by individual forest plans (see pages 65-66).

Two-aged Silviculture - Irregular Shelterwood

Alternative B would permit using irregular shelterwood method within compartments occupied by RCW where allowed by individual forest plans (see pages 67-68).

UNEVEN-AGED SILVICULTURE

Alternative B would allow uneven aged regeneration methods where allowed by individual forest plans. The use of uneven-aged methods (group and single tree selection) is described previously on pages 69-73.

MONITORING

Alternative B requires that 10 percent of clusters be visited annually to determine cluster status as part of the silvicultural inventory and evaluation process.

Forests should complete a resurvey of the 1980-82 baseline compartments as soon as possible, using the same basic techniques as the original survey. This survey should be completed on a 10-year cycle to develop and track 10-year trend data.

HABITAT FRAGMENTATION CONTROL

Habitat fragmentation will be controlled by requiring that foraging habitat be contiguous and continuous with the cluster, recruitment stand, and replacement stand.

SOUTHERN PINE BEETLE HAZARD REDUCTION

Alternative B recommends thinnings be used to maintain tree vigor and reduce southern pine beetle risk. The Forest Service would thin stands where southern pine beetle hazard was moderate or higher to achieve a minimum 20-25 feet spacing between trees, but maintain an overstory pine basal area of at least 60 square feet per acre. Alternative B would follow the standard Southern Region thinning guides. Those thinning guides recommend a range of 60 to 110 square feet of residual pine basal area, depending on site and stand conditions, and the availability of RCW foraging habitat.

Thinning criteria is described in detail in the Habitat Management-Thinnings section of this chapter. Thinning and other means to control southern pine beetle hazard is described in "Managing Southern Forests to Reduce Southern Pine Beetle Impacts" (USDA Forest Service, 1986).

CLEARING FOR NON-TIMBER MANAGEMENT PURPOSES

Cutting in suitable habitat for purposes such as oil and gas exploration, powerline or gas line rights-of-way establishment or maintenance may occur provided the site specific analyses indicates RCW is not likely to be adversely affected.

Alternative C

SUMMARY - ALTERNATIVE C

Alternative C is based on the establishment of HMAs and rotation lengths ranging from 70 to 200 years, depending on tree species and site quality. Rotation length is based on the assumption that longer lived trees growing on good sites develop heartwood at a slower rate. It also establishes five MILs and stresses the use of growing season burning to control midstory vegetation.

This alternative would set into motion an immediate and deferred set of actions, each containing various elements. These actions are described in detail in this chapter. The current conditions affecting the RCW and environmental effects are described in Chapter 3.

REVISED DIRECTION

The Forest Service would revise the Regional Wildlife Habitat Management Handbook, FSH 2609.23R (Handbook) and amend the Southern Regional Guide to incorporate the revised Handbook immediately after the Record of Decision (ROD) is signed. The revised Handbook would provide a new Regional Direction for managing the red-cockaded woodpecker and its habitat. This direction would be implemented after each National Forest with RCW populations individually amends or revises its Forest Plan. This would occur within one to three years after the signing of the ROD.

Elements of the Proposed Handbook Revision

Alternative C would:

(1) Establish criteria to delineate RCW Habitat Management Areas (HMAs) and determine population objectives to ensure demographic stability.

Alternative C is based on delineation of HMAs. The size of the HMA would be determined by the number and distribution of active and inactive clusters that existed in 1986. Each HMA would be classified as one of five management intensity levels (MIL) based on the risk of extirpation (local extinction) faced by the RCW population in the HMA. The risk categories are determined by a population's size and trend. The smaller and more dispersed RCW populations are at greater risk and would be managed and monitored more intensively.

(2) Establish Regional Handbook direction for management of the red-cockaded woodpecker and its habitat.

- o Emphasize the use of artificial cavities and the moving of RCW from area to area (translocation) to speed population expansion and eventual recovery of the species.
- o Establish rotation age between 70 and 200 years depending on pine species and site quality. Alternative C would produce timber products and woodpecker habitat on a sustained yield basis.
- o Emphasize thinning to reduce southern pine beetle risk and enhance RCW habitat.

- o Emphasize prescribed fire, including growing season burns, to control midstory vegetation in the pine and pine-hardwood forest types throughout HMAs, especially within clusters, recruitment stands and replacement stands.

- o Provide adequate foraging habitat (6350 pine trees greater than 10" diameter, 30 years old or older within 1/2 mile of and connected to the clusters).

- o Utilize a wide range of regeneration methods, with increased use of irregular shelterwood. The use of various silvicultural practices would be based on existing stand condition, site quality, and the need to balance current RCW habitat needs with regeneration of the forest to provide future habitat.

- o Limit regeneration of the oldest 1/3 of pine and pine-hardwood acres until rotation age. This will ensure suitable potential cavity trees in the shortest time.

- o Encourage restoration of longleaf and other desirable pine species in areas where they occurred historically and would benefit the RCW.

(3) Establish monitoring requirements to determine if the objectives of the new RCW management direction are being met.

- o Link monitoring intensity to management intensity level (MIL), which reflects the size and vulnerability of the RCW population.

IMMEDIATE ACTIONS

The Forest Service would amend 11 Forest Plans immediately through the Record of Decision. The affected National Forests are: Alabama, Chattahoochee-Oconee, Cherokee, Daniel Boone, Croatan, Florida, Francis Marion, Kisatchie, Mississippi, Ouachita, and Texas. These amendments would identify and delineate tentative HMAs. Tentative HMA delineation would follow the process used to determine permanent HMAs in the revised Regional Handbook. These procedures are described in detail in Appendix A. Tentative population objectives are identified based on acreage in tentative HMAs.

The Forest Service would allow thinning, irregular shelterwood (two-aged), single-tree and group selection (uneven-aged) methods within tentative HMAs outside the 3/4-mile radius circles.

The regeneration methods proposed will preserve future management options until the time when the new RCW regional direction can be fully implemented. Forest Plan revisions or amendments may take one to three years to complete. Interim protects 3/4-mile radius circles around existing (active and inactive) clusters. Tentative HMAs extend protection to the suitable habitat areas between clusters. The allowed regeneration methods retain relatively high basal area and canopy cover, which would allow a wide range of silvicultural options in the future and the continued harvest of some forest products.

The importance of restoring desirable pines, such as longleaf, to provide the RCW with sustainable quality habitat in the future, brings forth a possible exception to these regeneration method limitations. The interdisciplinary team concluded that the clearcutting method should be used to restore these pine species where it can be shown a definite long-term benefit would accrue and there is no short-term adverse effect on the RCW. Such exceptions would require site-specific environmental analysis. The approval process is described under Pine Restoration on page 54.

DETAILED DESCRIPTION-ALTERNATIVE C

Habitat Management Area Delineation

The establishment of Habitat Management Areas (HMA) is a key element of Alternative C (see page 44). The Forest Service proposes to delineate HMAs for all active RCW populations dependent on National Forest lands (See Figure I-2). The three National Forests that had RCW in the past 20 years but none at present, would decide whether to develop HMAs and actively manage reintroduced support populations. This decision would be deferred until the forests revise their Forest Plans.

The following is a summary of the HMA delineation process, which is explained in detail in Appendix A.

An individual HMA, tentative or permanent, should include sufficient acres of suitable habitat, foraging and nesting, to support at least 50 RCW groups. Recovery populations should have HMAs large enough to support 500 groups, if the land base will allow. Suitable RCW habitat includes pine and pine/hardwood forest types which have the potential to provide at least minimal RCW foraging habitat.

The delineation of HMAs is a three step process:

(1) Delineate the historic RCW population.

Consider current and historic cluster distribution, including any clusters on adjacent private land within 18 miles of Forest Service System lands.

(2) Identify isolated subpopulations.

Consult recent surveys which describe the current condition of RCW distribution. Include all groups separated by 5 miles or less of currently suitable foraging habitat or 3 miles or less of currently unsuitable foraging habitat. Include all inactive clusters within 5 or 3 miles using the above suitability criteria.

(3) Delineate the HMA boundary.

Establish an HMA for all populations having one or more multiple bird groups. Extend the boundary to include subpopulations separated by 18 miles or less of potentially suitable habitat.

Subpopulations separated by 3 miles or more of permanently unsuitable habitat should be placed in a different HMA. Permanently unsuitable habitat, such as lakes, agricultural lands, riparian hardwood bottoms, is determined by its inherent suitability and traditional use. Private land (inholdings) should neither be automatically excluded or included as suitable RCW habitat.

Extend the HMA boundary at least 1/2 mile and preferably 3/4 mile from the geometric center of clusters to allow the population to expand in any direction, by assuring they would find suitable habitat around those clusters, if land ownership will allow.

Create corridors that are at least 2.5 miles wide, linking isolated subpopulations, if possible. These corridors would ideally approximate the width of the subpopulations' habitat area being linked. Broad corridors allow the RCW from the various subpopulations to colonize the corridor area, which improves effective dispersal and social interaction throughout the HMA.

Delineate the HMA boundary to coincide with administrative, topographic, stand, and compartment boundaries for ease of administration.

Extend the HMA boundary beyond Forest Service System lands to include suitable habitat on adjacent public lands only where a Memorandum of Understanding (MOU) has been signed for the purpose of joint RCW management. For example: The Oconee National Forest and adjacent Hitchiti Experimental Forest have a joint agreement with the USDI-FWS, Piedmont National Wildlife Refuge.

Delineate the HMA boundary to exclude wildernesses, unless they have a wilderness management plan which allows prescribed burning and midstory control, essential management practices for maintenance of RCW habitat. All forests having essential RCW groups within a wilderness which is predominately longleaf pine are encouraged to develop such plans.

Appendix D includes maps identifying tentative HMAs for all active RCW populations on National Forest land.

Delineation of Tentative HMA Boundaries

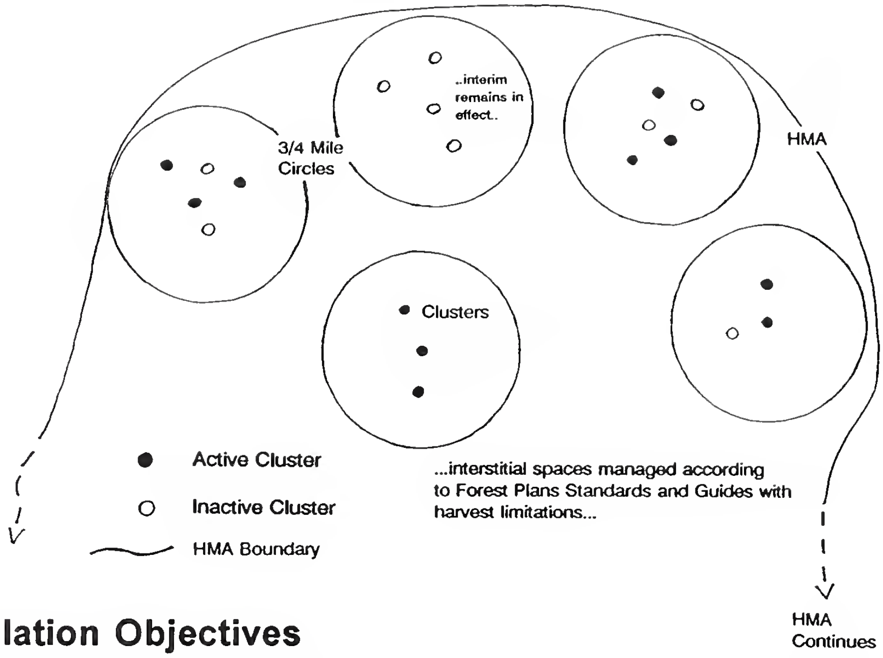
Full implementation of the new Regional RCW management direction may be delayed for two or more years due to the time necessary to complete forest plan revision/amendments. Interim S&Gs currently protect 3/4-mile radius circles around existing active and inactive clusters, but do not affect habitat outside the circles which would become part of the permanent HMA. The interdisciplinary team concluded immediate action was necessary to maintain future management options within the proposed HMA.

The interdisciplinary team feels it is essential to identify tentative HMAs immediately. This immediate action would allow thinnings, irregular shelterwood or uneven-aged methods, which retain relatively high basal areas and canopy cover. The maintenance of this number of trees allows a wider range of silvicultural options in the future. Clearcutting would also be allowed to restore pine species more desirable to the RCW, primarily longleaf and shortleaft pine. If a Forest chooses to begin restoration during the transition period between the signing of the ROD and their Forest Plan amendment or revision, the Forest must first identify sufficient recruitment stands and foraging habitat to meet their tentative population objective identified in Table 2-C1.

These limitations apply to the areas within the tentative HMA but outside the 3/4-mile radius circles. Forest plan rotations, allowable sale quantities, etc., within these areas, will not be changed at this time. Any such changes will occur when the individual forest plans are revised/amended.

Tentative HMAs would be delineated using the process summarized on the preceding page and detailed in Appendix A. The boundaries would be finalized as a part of the forest plan amendment/revision to incorporate the new Regional RCW management direction. Figure 2-1 illustrates how the tentative HMA strategy may appear when implemented on the ground.

Figure 2-C1
Tentative HMA Diagram
The proposed action would prescribe RCW management activities within tentative HMAs and outside of the 3/4-mile circles.



Setting Population Objectives

The Forest Service proposes to establish a population objective for each HMA. Population objectives are determined after the HMA has been delineated and are based on the area of suitable RCW habitat within each HMA. Appendix A presents a detailed description of this process. The Fish and Wildlife Service determined that a recovered population should have at least 250 groups annually fledgling young (reproducing population). In the absence of population-specific reproductive data, a population objective of 500 active clusters should be used. If the land base allows, recovery populations will be managed to sustain 500 active clusters or a reproducing population of 250. Support populations would be managed for a minimum of 50 groups. However, most support populations will have population objectives well above this minimum. Table 2-C1 lists the tentative population objective for each RCW population based on tentative HMA size.

The acreage needed to support a single RCW group varies by physiographic province. For example, habitat quality in the lower coastal plain is usually very high; therefore, a density objective of one group per 200 acres of suitable habitat will be used. Habitat quality in the piedmont is lower, so a density objective of one group per 300 acres will be used.

Table 2-C1

Tentative Habitat Management Areas (HMA) and Population Objectives.

Tentative HMAs are based on the distribution of existing active and inactive clusters (colony sites) rather than the current RCW population.

STATE	National Forests with HMAs (RECOVERY POP. UND)	Tentative HMA Area (Acres)	Population 1994	Tentative Pop. Objective
			(Active Clusters)	
ALABAMA	Bankhead	20,402	0	68
	Conecuh	61,817	14	309
	Talladega-Oakmulgee Rd	98,584	120	394
	Talladega/Shoal Creek Rd	124,247	4	413
		305,050	138	1,184
ARKANSAS	Ouachita	68,521	15	228
FLORIDA	Apalachicola-			
	Apalachicola RD	141,263	500	706*
	Wakulla RD	144,368	150	722*
	Ocala	48,400	4	242
	Osceola	98,183	45	462
		432,214	699	2,132
GEORGIA	Oconee/Hitchiti **	52,966	16	176**
KENTUCKY	Daniel Boone	48,487	3	66
LOUISIANA	Kisatchie-			
	Catahoula RD	65,734	27	328
	Evangeline RD	46,298	52	231
	Kisatchie RD	59,267	69	296
	Vernon RD	64,243	186	321
	Winn RD	56,297	18	281
		291,839	352	1,457
MISSISSIPPI	Bienville	125,160	92	500
	DeSoto-			
	Biloxi RD	38,293	5	191
	Black Creek RD	35,467	1	177
	Chickasawhay RD	100,494	4	502
	Homochitto	67,755	27	225
		367,169	129	1,595
N.CAROLINA	Croatan	27,940	55	139
S.CAROLINA	Francis Marion	125,351	371	625*
TENNESSEE	Cherokee	6,150	1	n/a
TEXAS***	Angelina/Sabine	66,286	42	329
	Davy Crockett	65,016	38	325
	Sam Houston	105,194	149	525
		236,496	229	1,179
SOUTHERN REGION		1,962,183	2,008	8,781

* These populations can be declared recovered (MIL1) when they reach 500 active clusters and meet all other criteria needed for recovery.

** The Oconee NF is combined with Hitchiti Experimental Forest and Piedmont National Wildlife Refuge by Memorandum of Understanding (FSM 2609.23). The figures listed, however, show only the National Forest acreage and population objectives.

*** The National Forests in Texas are currently managed under a court order, which will remain in effect until the order is removed or a new order is issued by the District Court.

Management Intensity Levels

Management Intensity Levels are a key element of Alternative C (see pages 44-46).

Two sets of MIL classification criteria were developed for Alternative C: one set for populations with a land base large enough to support 500 groups, and another set for populations with inadequate acreage to support 500 groups. Tables 2-C2 and 2-C3 show the MIL breakdown for these two situations, respectively.

Table 2-C2

MIL Criteria for RCW Populations with Land Base to Support 500 Groups

Potential breeding pairs or active clusters should be used when lacking accurate reproduction data to determine MIL for a population or subpopulation.

Management Intensity Level (MIL)	Reproducing Population	Potential Breeding Pairs	Active Clusters
MIL 1 (Recovered/Low risk) A population size of: with a stable or increasing population trend.	≥ 250	≥ 400	≥ 500
MIL 2 (Moderate risk) A population size of: with a decreasing population trend: or	≥ 250	≥ 400	≥ 500
A population size of: with a stable or increasing population trend.	125-249	200-400	250-499
MIL 3 (Severe risk) A population size of: with a decreasing population trend; or	125-249	200-399	250-498
A population size of: with a stable or increasing population trend.	50-124	80-199	100-248
MIL 4 (Acute risk) A population size of: with a stable or decreasing population trend; or	50-124	80-199	100-248
A population size of: with a stable or increasing population trend.	25-49	40-79	50-98
MIL 5 (Extreme risk) A population size of: regardless of trend; or	≤ 25	≤ 40	≤ 50
A population size of: with a decreasing population trend.	25-49	40-79	50-98

The following MIL breakdown will apply to RCW populations occurring on Forest Service units which do not have adequate acres to support 500 groups. Two assumptions are made: The population objective in these HMAs will always be expressed as total active clusters, and the minimum population objective will be 50 active clusters.

Table 2-C3
MIL Criteria for RCW Populations Without Land Base to Support 500 Groups
Percentages represent the percentage of the HMA's population objective in total active clusters.

Management Intensity Level (MIL)	Reproducing Population	Potential Breeding Pairs	Active Clusters
<u>MIL 1 (Recovered/Low risk)</u>			
A population size of: with a stable or increasing population trend.	≥ 50%	≥ 80%	≥ 100%
<u>MIL 2 (Moderate risk)</u>			
A population size of: with a decreasing population trend: or	≥ 50%	≥ 80%	≥ 100%
A population size of: with a stable or increasing population trend but not less than 50 groups.	25%-49%	40%-80%	50%-99%
<u>MIL 3 (Severe risk)</u>			
A population size of: with a decreasing population trend but not less than 50 groups; or	25%-49%	40%-79%	50%-99%
A population size of: with a stable or increasing population trend but not less than 50 groups.	10%-25%	16%-40%	25%-49%
<u>MIL 4 (Acute risk)</u>			
A population size of: with a stable or decreasing population trend, but not less than 50 groups; or	10%-25%	16%-40%	25%-49%
A population size of: with a stable or increasing population trend, but not less than 50 groups.	5%-10%	8%-16%	< 25%
<u>MIL 5 (Extreme risk)</u>			
A population size of: regardless of trend; or	≤ 25*	≤ 40*	≤ 50*
A population size of: with a decreasing population trend, but not less than 50 groups.	5%-10%	8%-16%	< 25%

* Not a percentage, actual number of groups.

An example of how to use this table: The population objective for an HMA is 321 active clusters determined by acres of potentially suitable habitat and density objective for specific physiographic province. The current population is 186 active clusters with an increasing trend the last 5 years. Reproducing population or group equivalents are unknown.

$$\frac{\textbf{Current Population}}{\textbf{Population Objective}} = \textbf{\% of Population Objective}$$

$$\frac{186}{321} = 58\%$$

Fifty-eight percent of the population objective is currently active clusters with an increasing population trend. In the table, this population falls in MIL 2 and would be managed accordingly.

Table 2-C4 briefly describes the different MILs and management practices associated with each.

Establishment of Subhabitat Management Areas

The establishment of sub-HMAs is not a management option in Alternative C.

Table 2-C4

Summary of Proposed RCW Management by MIL.

The RCW populations facing higher risk of extirpation are given progressively higher levels of habitat protection.

Risk Level Criteria	RECOVERED MIL 1 *	MODERATE RISK MIL 2 *	SEVERE RISK MIL 3 *	EXTREME RISK MIL 4 *	ACUTE RISK MIL 5 *
Population Size & Trend (Reproducing Groups)**	≥250 increasing or stable.	≥250 decreasing or 125-249 stable/ increasing	125-249 decreasing or 50-124 increasing	50-124 stable/ decreasing or 25-49 stable/ increasing	<25 all trends or 25-49 decreasing
Rotation Age (Years for various pines)***	Vary by forest type and site quality (site-index);	Same as MIL 1	Same as MIL 1	Same as MIL 1	Same as MIL 1
Silvicultural Practices***	A wide range of Silvicultural options allowed, including even-aged, two-aged, and uneven-aged management.	Similar to MIL 1, but emphasizes irregular shelter-wood with staged removal of seed producing trees. Retention of 6 trees per acre optional.	Same as MIL 2 and Retention of 6 trees per acre required.	Same as MIL 3	Same as MIL 4, plus all seed trees retained as long as Population is in MIL 5.
Maximum Regeneration Patch Size***	Forest Plan guidelines	Forest Plan guidelines	Forest Plan guidelines	Average less than 25 acres	Average less than 25 acres
Nesting Habitat Provision	Extended rotations, reserve relicts and potential cavity trees in all thinnings, and protect 1/3 of oldest acres of pine until near rotation age.	Same as MIL 1	Same as MIL 2, plus required replacement and recruitment stands and an average of 6 potential cavity trees per acre would remain in regeneration areas.	Same as MIL 3	Same as MIL 4, except all seed trees would be retained.
Fragmentation Prevention***	Extended rotations***	Same as MIL 1	Same as described for MIL 2, plus 6 trees per acre would be retained indefinitely***	Same as MIL 3, plus regeneration patch size limits and no regeneration cutting within 1/4 mile of active clusters.***	Same as MIL 4, plus all seed producing trees would be retained as long as population is in MIL 5.***
Prescribed Burning	Prescribed burning will be used intensively in all MILs to aid in control of midstory vegetation in RCW habitat. Other control methods, manual, mechanical or chemical may be necessary.				

* When an RCW population is re-assigned to a new MIL, the management practices for the newly assigned MIL would be implemented from that time forward.

** All population sizes refer to number of actively breeding RCW groups. Actual number of active groups may be greater.

*** Extended rotations, harvest method and patch size limits listed for each MIL all contribute in reducing RCW habitat fragmentation.

PROTECTION OF CLUSTERS, REPLACEMENT, AND RECRUITMENT STANDS

The Forest Service proposes to incorporate the following standards and guidelines into the revised Handbook to ensure that RCW clusters, recruitment stands, and replacement stands (described on page 46) are not adversely affected by other forest management activities.

Cutting

All alternatives would prohibit timber harvest, cutting or killing of trees within clusters, recruitment stands, and replacement stands except where those actions would protect or improve RCW habitat. Snags or other dead trees would not be removed unless they pose a threat to public safety.

The alternatives would prohibit cutting of cavity trees in active and inactive clusters unless they posed a threat to public safety, or to protect the cluster, recruitment stand and replacement stand from insect attack. The Fish and Wildlife Service shall be consulted and would issue a concurrence before any cavity tree would be cut.

Motorized, Heavy Equipment, and Concentrated Human Use Areas

Alternative C requires habitat improvement projects involving motorized or heavy equipment to include sufficient project administration and/or contract language to protect the cluster, recruitment stand, and replacement stand, especially cavity trees and potential cavity trees.

These alternatives would prohibit concentrated equipment use, such as log decks, pine straw bailing operations, off-road vehicle trails, trail heads, and campsites within clusters, recruitment stands, and replacement stands.

The Forest Service will relocate or modify existing uses and activities if they are found to adversely affect the RCW.

Cavity Tree Protection During Prescribed Burning Operations

All alternatives encourage prescribed burning to control midstory vegetation for the benefit of the RCW, but require the burning prescription and cycles to minimize risk to cavity trees.

Cavity trees may be protected by raking away or back burning adjacent fuels. Plow lines will be excluded from clusters unless needed to protect the cavity trees during an emergency.

Nesting Season Disturbance

The Forest Service would require scheduling all potentially disturbing activities within the cluster before or after the nesting season. The general nesting season dates will be used unless the specific group's nesting season is documented and monitored to account for individual variation.

The Forest Service would also restrict its habitat improvement activities within clusters during the nesting season, unless such activity during the nesting season is necessary for the continued survival of the RCW group. An exception to this limitation is prescribed burning, which may be allowed.

Construction Of Rights-of-Way

Alternative C would prohibit all construction of linear rights-of-way, such as roads, power lines, or pipelines within a cluster, recruitment stand, or replacement stand.

Existing Rights-of-Way Reconstruction and Maintenance

Alternative C would allow reconstruction or maintenance of existing roads through clusters, recruitment stands, and replacement stands if detailed study shows such activities will not adversely affect RCW and the activities are scheduled before or after the nesting season.

Road and right-of-way reconstruction/maintenance through clusters will be closely monitored to ensure protection of cavity trees and potential cavity trees.

Southern Pine Beetle Suppression

The Forest Service will attempt to minimize the impact of southern pine beetle to cavity trees and foraging habitat. When RCW clusters, recruitment stands, and replacement stands are threatened by southern pine beetles, a biologist and entomologist would recommend a course of action before taking control measures.

The Southern Pine Beetle Record of Decision (USDA-FS, 1987, p. 33), sets standards and guidelines for protecting both cavity trees and the RCW during control operations as follows:

- Prohibits cutting of trees already vacated by beetles unless they pose a threat to public safety.
- Allows cutting of inactive or relict cavity trees, if infested within a designated treatment buffer zone only to protect the rest of the cluster.
- Allows cutting of uninfested trees within 200 feet of a cavity tree only to protect cavity trees.
- Prohibits cut and remove operations during nesting season.
- Allows only minimal disturbance, such as cutting or chemical treatment, if necessary to protect the cavity trees during nesting season.
- Prohibits the use of the pile and burn control technique within clusters.

Alternative C considers wilderness RCW groups essential to recovery. As such, southern pine beetle control will occur in wildernesses to protect these groups as discussed in the Final Environmental Impact Statement for the Suppression of the Southern Pine Beetle, following the criteria established in the Record of Decision for that document (USDA Forest Service 1987). The Record of Decision stated only essential groups and their foraging habitat would be protected. The criteria that triggers initiation of control action are the southern pine beetle infestation must be within 1/2 mile of an essential group, adverse effects are likely to occur within the next 30 days, and the continued existence of the group is in question.

MANAGEMENT OF CLUSTERS, REPLACEMENT, AND RECRUITMENT STANDS

The Forest Service proposes to actively manage RCW clusters, recruitment stands, and replacement stands to ensure continued viability and population growth.

Marking Cavity Trees and Cluster Boundaries (Monumentation)

All alternatives require the marking of cavity trees to reduce the risk of accidental damage. The Forest Service needs to know where the cavity trees are located on-the-ground to consistently apply the protective standards and guidelines and monitor the cluster.

Cluster boundaries must be marked for easy recognition, but the marking may be temporary (signs) instead of permanent (paint). The marking of cavity trees and cluster boundaries must be updated when a project that would alter the habitat, such as harvest or road construction, is planned within 1/4 mile of a cluster (active and inactive).

Cluster Status - Data Base Management

The Forest Service will maintain and update a data base which includes status category of all RCW clusters within the HMAs. The data base will link monitoring and survey data and show areas where replacement and recruitment stands are necessary.

Alternative C would recognize and require tracking of six cluster status categories (active, inactive, abandoned, historic, destroyed, and invalid) which are defined in the glossary.

Cavity trees will be preserved in all cluster categories, but special cluster management is not required for abandoned, historic, destroyed, or invalid clusters unless identified as recruitment or replacement stands.

Changes in cluster status should be tracked and the data base updated annually. Active clusters may be declared inactive if no RCWs are living in them. Table 2-C5 shows when an inactive cluster may be declared abandoned if not identified as a recruitment or replacement stand.

Table 2-C5
Abandoned Cluster Timetable
Inactive clusters in MIL 2 through MIL 4 with declining populations and all MIL 5 populations cannot be declared abandoned.

MIL	Population Trend	Minimum Time (Years)
1	Stable or Increasing	5
2	Stable or Increasing	10
2	Decreasing	n/a
3	Stable or Increasing	10
3	Decreasing	n/a
4	Stable or Increasing	10
4	Decreasing	n/a
5	Any Trend	n/a

n/a: Cannot be declared abandoned

Recruitment Stands

Alternative C would establish recruitment stands, which are crucial for achieving population objectives.

The Forest Service will establish recruitment stands in each compartment within an HMA where the population objective exceeds the current RCW population. Recruitment stands are optional in MIL 1 and MIL 2. The total number of recruitment stands should equal the HMA population objective minus the number of groups in that HMA.

The selection criteria include:

- Nesting suitability considering stand age, forest type, and availability of relicts.

  The oldest available stands or younger stands with sufficient relicts should be selected. Inactive clusters may also be designated as recruitment stands. Midstory control should be completed and recruitment stands may be improved by installing artificial cavities.

- Distance to a cluster.

  Recruitment stands should lie within 1/4 mile to 3/4 mile from a cluster or other recruitment stands to ensure good spatial distribution and increase probability of colonization.

- Must have adequate suitable foraging habitat connected to the cluster or recruitment stand.

- Clusters inside wilderness.

  Recruitment stands for RCW groups living in wilderness should be located outside the wilderness boundary. This action would encourage the RCW population to extend itself away from the wilderness into the HMA where the clusters can be managed for its benefit. Wildernesses are excluded from HMAs unless the specific wilderness management plan can accommodate RCW management.

- Clusters on private land.

  Recruitment stands should be established for RCW groups living on adjacent private lands within 3/4 mile of Forest Service System lands. These stands should be located on National Forest lands as close to the cluster as possible. This action would encourage the RCW to move to Forest Service lands where cluster management can take place.

Replacement Stands

Alternative C would establish replacement stands, for all active clusters. Replacement stands are optional in MIL 1 and MIL 2. A replacement stand will be selected for all nonwilderness and essential wilderness groups.

The selection criteria include:

- Nesting suitability considering stand age, forest type, availability of relicts.

  Inactive clusters may be designated as replacement stands.

- Distance to a cluster.

  A replacement stand should be adjacent to the cluster if possible, and no more than 1/2 mile from it.

- Clusters inside wilderness.

  Replacement stands for essential RCW groups living in wildernesses should be established as close to the cluster as possible, but located outside the wilderness boundary.

- Cluster on private land.

  Replacement stands would not be established adjacent to clusters on private lands until the group had moved onto National Forest land.

Midstory Vegetation Control

Alternative C would require midstory removal and control be completed in all clusters, recruitment stands and replacement stands outside of wildernesses and should be completed for all essential wilderness groups. RCWs typically abandon their nests when adjacent midstory trees grow taller than the cavity (see page 47 for additional discussion).

The Forest Service will do midstory control over the entire stand, at least 10 acres for each cluster. The treatment should eliminate all hardwood midstory trees within a 50-foot radius of all active and inactive cavity trees. Total basal area of hardwoods should be less than 20 square feet.

Pine midstory should be controlled before the trees block access to cavity trees, potential cavity trees and line-of-sight between them. Dominant and codominant hardwoods should be removed from the cluster, recruitment stand and replacement stand unless a site-specific analysis indicates their removal would decrease the suitability of the stand for RCW. At no time should more than 20 square feet of basal area of dominant and codominant hardwoods be retained. Evaluate the need to remove obstructing dominant and codominant pine and hardwood stems, within 50 feet of cavity and potential cavity trees.

In areas where cluster, recruitment stand or replacement stand boundaries may include natural hardwood areas, such as stream bottoms, no treatment should occur to eliminate hardwoods or to control midstory within the natural hardwood area unless absolutely necessary to maintain the viability of the RCW group.

Outside clusters, recruitment stands, or replacement stands but within the HMA, the reduction of hardwood midstory is encouraged in the pine and pine-hardwood forest types. The objective is improvement of foraging habitat. Prescribed burning will be the primary tool to accomplish this objective.

Emphasis should be placed on growing season burning, especially in those habitats which were naturally maintained by growing season fires: e.g., longleaf pine/wiregrass, longleaf pine/bluestem and shortleaf pine/bluestem. After midstory is controlled, burning during other seasons can be used infrequently.

The Forest Service will prioritize and schedule maintenance burns for those clusters, recruitment stands and replacement stands having already received initial treatment to eliminate midstory. Maintenance would receive priority to ensure previous investments in initial midstory control are not lost.

Artificial Cavities

Artificial cavities and their role in the recovery of the RCW have been previously described on pages 47-51. Alternative C would require artificial cavities in MIL 2 through MIL 5, and in addition recommends start-holes for higher-risk populations as shown in Table 2-C6.

The Forest Service will use the procedures and methods specified by Taylor and Hooper (1991) and Allen (1991) to construct or install artificial cavities in suitable trees. Only individuals experienced in the respective techniques should install artificial cavities. Midstory vegetation must be controlled in conjunction with installation of artificial cavities. The Forest Service would prioritize and schedule installations to provide cavities where they are needed most.

The following priorities will be used:

(1) Active clusters with a single cavity tree.

(2) When needed to support translocation efforts.

(3) Active clusters with fewer than four usable cavities.

(4) Inactive clusters with fewer than four usable cavities within one mile of an active cluster.

(5) Recruitment stands within one mile of an active cluster.

(6) Inactive clusters with fewer than four usable cavities within three miles of an active cluster.

(7) Recruitment stands within three miles of an active cluster.

(8) Inactive clusters or recruitment stands more than three miles from an active cluster.

As the priorities imply, artificial cavities should first be installed in or very near active clusters and then progressively move to stands further away.

Table 2-C6
Artificial Cavity Requirements
Drilled start holes are recommended in MIL 3 through MIL 5 in addition to completed drilled cavities or cavity inserts.

MIL	Artificial Cavities	Specified Type
1	Optional	As appropriate
2	Required	As appropriate
3	Required	Complete cavities plus >2 start holes
4	Required	Complete cavities plus >2 start holes
5	Required	Complete cavities plus >2 start holes

Reducing Cavity Competition

Cavity restrictors are metal plates with an oblong hole large enough for the RCW (generally 1-3/4" by 2-3/4" as shown in **Figure 2-3**). Cavity restrictors are placed around cavity entrances to prevent other birds (especially pileated and red-bellied woodpeckers) and mammals from enlarging them and displacing the RCW (Carter et al 1989). Limited cavity availability in some areas, has adversely affected the RCW. Cavity competition can be minimized by the following:

- Ensure that each group has at least four functional cavities through use of restrictors and/or artificial cavities.

- Within 1/2 mile of active RCW clusters and inactive clusters or recruitment stands that have been made suitable for augmentation, retain uninfested/SPB vacated single dead trees. Within 1/4 mile of inactive RCW clusters which are not suitable for augmentation, retain uninfested/SPB vacated single dead trees. In SPB spots one acre or larger in size, retain six vacated sawtimber trees per acre, if available, two of which should be the larger vacated trees. In SPB spots less than one acre, retain two larger vacated sawtimber trees, if available. Research suggests presence of snags with cavities in and near clusters may reduce competition for RCW cavities (Harlow and Lennartz 1983, Kappes 1994). This does not preclude salvage of dead trees from large areas resulting from insect outbreaks, hurricanes, tornadoes or other catastrophic occurrences.

- Maintain adequate levels of midstory control. This creates an unsuitable habitat condition for some cavity competitors.

- Install squirrel and snake excluder devices (non-lethal) as needed (Montague and Neal 1995, Withgott et al. 1995).

Cavity restrictors should be placed on enlarged RCW cavities and on unenlarged cavities where experience shows cavity enlargement is likely. The highest priority is active clusters which have a single cavity tree followed by single bird groups, then those clusters with 2 to 4 suitable cavities, and 5 to 8 cavities.

All artificial cavities should be fitted with restrictors when installed.

Restrictors should not be used on cavities which have been enlarged internally to the point of being unusable by RCW.

The Forest Service will monitor cavity restrictors to ensure proper installation and acceptance by the RCW.

Cavity restrictors and their role in the recovery of the RCW have been previously described on page 51-52. Alternative C requires the use of restrictors, where needed, in MIL 2 through MIL 5, and in MIL 1 if warranted by the particular site-specific conditions.

Translocation

Translocation of RCW and its role in the recovery of the RCW have been previously described on pages 52-53.

The Forest Service will develop priorities and schedule translocation of RCW to best achieve the desired objectives. Priorities are usually based on the spatial distribution of existing groups and the probability of natural dispersal of juvenile RCWs being successful. Any single bird group could be a candidate for augmentation with a juvenile of the appropriate sex.

However, if a single bird group is more than a mile from another group containing a breeding pair, it would be a higher priority than a single bird group which had four or more breeding groups within the same mile distance. This is because the RCW in the second example has a much higher probability of receiving a new mate through natural dispersals than does the one which is far removed from a breeding group.

The priorities for reintroduction of RCW groups varies by management objective. If the technique is being used to expand an existing population, the priorities would be similar to those above for augmentation. It is also suggested this method not be used until all single bird groups in the population have been augmented.

If the management objective is the reestablishment of RCW into currently unoccupied habitat, those areas known to have held RCW since 1970 should be first priority.

The translocation of RCW within populations/subpopulations is encouraged. The short distances birds must be moved and the often similarity of the habitat may increase the probability of successful pairings. If translocations between populations are necessary, it is desirable to move birds between areas that are of similar latitude, elevation and forest type.

The planned translocation of RCW will be required to maintain the genetic viability of populations with a reproducing population of less than 250. The effectiveness of such translocations will depend on the number of RCW moved to a specific population and the genetic makeup of these birds in relation to the receiving population. Such genetic exchanges can be through normal sub-adult augmentation.

The objective is to identify all single bird groups and move an appropriate sex juvenile bird to it, in an effort to create a breeding pair. Priority should be given to single bird groups in RCW populations with fewer than 50 active clusters.

HABITAT MANAGEMENT WITHIN HMAs

The area within HMAs and outside of cluster, recruitment stand, and replacement stand boundaries would be managed for a full range of multiple uses, but also emphasize the sustained production of RCW foraging and future nesting habitat.

Prescribed Burning

The Forest Service should annually prescribe burn approximately 490,000 acres (based on tentative HMA acreage and a four-year burning cycle) within HMAs throughout the Southern Region. Prescribed burning during the growing season would be emphasized where appropriate. See pages 53-54 for additional discussion.

Pine Restoration

As important as restoring desirable pine species is to the long-term survival and recovery of the RCW, it is important to schedule pine restoration to minimize any age-class bulges in the pine type age class distribution. The Forest Service would base the rate for pine restoration on rotation and age-class distribution for the forest type currently occupying the site.

For example: A longleaf site is currently occupied by loblolly pine. The rotation for loblolly on that site in Alternative C is 110 years. The rate at which the loblolly would be harvested and planted to longleaf would be based on the loblolly rotation, which would allow 10 percent of the area to be restored each decade. This allows an accelerated rate of restoration. For comparison, if the restoration rate was based on the 150-year rotation for longleaf on that site, only 6.7 percent of the area could be restored per decade.

If the acreage of longleaf in the 0-10 year age class, due to restoration, equals or exceeds the acreage allowed for a given rotation, no longleaf could be regenerated that decade.

When restoration is complete, all restored acres are calculated in the restored pine type age-class distribution. See page 54 for additional discussion.

Foraging Habitat Management

Alternative C would provide foraging habitat as described on pages 54-56.

The Forest Service would evaluate foraging habitat within 1/2 mile of clusters and recruitment stands when pine tree removal is planned to ensure adequate foraging habitat is available after any harvest. Procedures described in the Fish and Wildlife Service Blue Book (USDI-FWS 1989) will be followed.

Hooper and Lennartz (1995) suggest there may be some circumstances when a RCW population would benefit in the long-term by having its foraging habitat reduced below 6350 stems. Some examples of such circumstances are: (1) in the thinning of pine stands to reduce the risk of southern pine beetle infestation (Thatcher et al. 1986); (2) in the removal of trees infested with southern pine beetles in order to avoid a major outbreak (Billings and Varner 1986).

The Forest Service goal is to provide the highest quality foraging habitat as close as possible to RCW clusters and recruitment stands rather than large areas of poor habitat. Thinning within RCW foraging habitat should maintain at least a 70 square feet of pine basal area. Where foraging habitat is limited, the Forest Service will make thinning stands less than 10 inches diameter within 1/2 mile of the cluster (closer to the cluster the better) a priority action. This action helps these trees grow faster and shortens the time required for these stands to become suitable foraging habitat. The Forest Service will use standard silvicultural prescriptions for thinning young stands.

The Forest Service must provide 100 percent of the foraging habitat equivalent for RCW groups whose 1/2 mile foraging zone extends onto another ownership (private, state, or other federal) without a cooperative agreement with the non-Forest Service landowner.

The Forest Service will provide its proportional share of foraging for RCW groups on adjacent private, state, or other federal ownership but within 1/2 mile of National Forest land, if no cooperative agreement exist with the non-Forest Service landowner.

The cooperative RCW agreement that ensures adherence to the Fish and Wildlife Service foraging habitat procedures. This agreement would allow foraging habitat equivalents to be shared in proportion to their availability between the Forest Service and adjacent landowner or agency.

Future Nesting Habitat

A long-term objective of Alternative C is to provide all future nesting habitat through extension of rotation lengths. However, as long as stands are too young to provide future nesting habitat and RCW populations are small and/or declining all options described on page 56-57 will be implemented to ensure adequate future nesting habitat.

To provide future nesting habitat in the shortest period of time Alternative C requires retention of the trees (by forest type) on the oldest third of existing acres within the HMA until rotation age, during the first rotation. The first regeneration to occur in the oldest 1/3 should take place in the youngest of these stands.

In addition, relict trees should not be removed during thinning operations unless they are spaced so closely that overall nesting habitat suitability is decreased. In such a situation the relicts should be thinned to a minimum spacing of 20-25 feet.

Thinning older stands or young stands with scattered relicts will increase their suitability as nesting habitat. Such thinnings can be used to stimulate colonization and promote population expansion. These thinned stands could also be used to lure RCW groups from a high risk or poor management situation into a location where their habitat can be managed. For example, an RCW group in wilderness or on private land could be lured into an HMA by improving potential nesting habitat along the wilderness or property boundary.

As forest stands approach the age to provide suitable nesting habitat, manage them to create the optimal stand structure which attracts colonizing RCW - an open, park-like stand with potential cavity trees free from obstruction by midstory or larger stems. They should be thinned to maintain a pine basal area of 60 to 80 square feet and a minimum spacing of 20-25 feet between the dominant and codominant trees. The spacing is actually more critical than the basal area. If the trees in the stand are greater than 14 inches in diameter, the basal area guideline will provide adequate spacing.

Thinning

Thinning of forest stands is a key activity in the production of good RCW habitat and is an important element of Alternative C (see pages 57-59).

Thinning of mature stands to enhance RCW habitat will vary depending on stand age. Stands between the ages of 30 and 70 will be managed primarily as foraging habitat.

Use the following guidelines:

- Maintain pine basal area of 60-110 square feet depending on site quality.

- If total pine basal area exceeds 100 square feet, do not remove more than 30 square feet of basal area in any single thinning operation.

– The priority for selecting pine trees to remain in all MILs are:

(1) relict trees
(2) other potential cavity trees
(3) trees greater than 10 inches diameter that are not potential cavity trees
(4) trees less than 10 inches diameter

As stands become suitable as potential cavity trees, 70 years old and older, the following thinning guidelines will be used:

– Maintain pine basal area between 60 and 80 square feet.

– Ensure proper spacing to reduce southern pine beetle risk, 20-25 feet or more.

– Priority for selecting pine trees to remain are the same as above.

Regeneration and Sustaining RCW Habitat

The Forest Service would emphasize natural regeneration methods and prescribed fire as the primary seedbed preparation method, where site conditions allow. There are many PETS species found in the same habitats as the RCW. Site-specific biological evaluation and environmental accessments are designed to ensure PETS species are protected when vegetation management projects occur.

The Forest Service would use even-aged, two-aged, and uneven-aged regeneration methods, with specific limitations based on MIL that would be more stringent for HMAs with higher risk RCW populations (see pages 59-73).

- Clearcutting is allowed in all MILs for the regeneration of: Virginia and pitch pine, slash pine on wet sites, understocked or damaged stands, and stands being restored to longleaf or other desirable pine species.

  Seed-tree and shelterwood methods with or without reserve trees are allowed in MIL 1 and MIL 2.

  Irregular shelterwood (two-aged method), which reserves the parent trees for an extended or indefinite period, is the primary regeneration method in MIL 3 through MIL 5.

- Regeneration patch size must average 25 acres or less in MIL 4 and MIL 5; patch size MIL 1 through MIL 3 is governed by Forest Plan standards and guidelines.

- Within MIL 4 and MIL 5, special project coordination is required within 1/4 mile of the geometric center of an active cluster and recruitment stand. Within this zone, planned regeneration should normally not occur. In special circumstances, restoration of longleaf or shortleaf pine can occur if there are no short-term impacts to the RCW and there is a long-term benefit to the RCW. Within this zone, permanent clearing, removal, or loss of habitat should not occur.

Table 2-C7 summarizes the general regeneration methods available for RCW habitat management by forest type. Some methods are limited to specific conditions and not necessarily all methods are available for all MILs.

Table 2-C7
Appropriate Regeneration Methods by Forest Type

Regeneration Method	FOREST TYPES				
	Virginia Pine	Loblolly Pine	Shortleaf Pine	Slash Pine	Longleaf Pine
Shelterwood/Seed-tree	No	Yes	Yes	Yes	Yes***
Clearcutting*	Yes	Conversion to Longleaf or Shortleaf	No	Conversion to Longleaf or Shortleaf	No
Irregular Shelterwood	No	Yes	Yes	Yes	No
Group Selection	No	Yes	Yes	No	Yes
Single-Tree Selection	No	Maybe**	Maybe**	No	No

* See exceptions for damaged stands and wet slash pine sites
** May not produce suitable nesting habitat
*** Shelterwood only

EVEN-AGED AND TWO-AGED SILVICULTURE

When using even-aged and two-aged silviculture, trees (stands) are selected for regeneration based on their age. An objective is a balanced distribution of age classes. To ensure habitat availability for all RCW groups, age classes must be balanced by compartment.

Table 2-C8 shows Alternative C's minimum rotation ages to be used within RCW HMAs by forest type and site index. Rotation ages for pine-hardwood forest types would be set by the pine species present.

Table 2-C8
Rotation Ages by Forest Type and Site Index
Rotation age varies by forest type and site index.

SITE INDEX	FOREST TYPES VIRGINIA PINE	LOBLOLLY PINE	SHORTLEAF PINE	SLASH PINE	LONGLEAF PINE
POOR (site 60 & below)	N.A.*	80(12.5%)**	100(10%)	80(12.5%)	100(10%)
AVERAGE (site 70-80)	60(16.7%)	100(10%)	150(6.7%)	100(10%)	150(6.7%)
GOOD (site 90 and above)	80(12.5%)	120(8.3%)	200(5%)	120(8.3%)	200(5%)

* Poor site Virginia pine will not produce trees large enough to become a potential cavity tree.
** The number in parenthesis is the percentage of an area which can be regenerated per decade based on A/R x T.

The Forest Service would calculate appropriate regeneration acres within each compartment based on:

- The acres of suitable RCW habitat (pine and pine-hardwood forest types with the potential to produce suitable foraging habitat) within each compartment that are identified as suitable for timber management (Land Class Codes 500 and 600).
- The rotation that is applied to each forest type represented.
- The existing acreage of each forest type which is in the 0-10 and 0-30 age classes by compartment.
- Additional mitigation measures which are identified and discussed in the following sections on the various harvest methods.
- The MIL of the RCW population in question.

The Forest Service must consider the effects of catastrophic impacts from insect, disease, fire, or weather, when considering age-class distribution calculations for planned regeneration. For example, if a tornado destroyed 1000 acres of pine habitat within the HMA, that acreage must be included in the 0 to 10 age-class. All temporary openings less than 10 acres, such as cuttings to control southern pine beetle, must also be included in the 0-10 or appropriate age class.

Even-Aged Silviculture - Clearcut

Alternative C would allow clearcutting within all MILs for specific situations. A site specific analysis must show a definite long-term benefit and no short-term adverse effects on RCW.

The site specific analysis must show:

- Sufficient foraging habitat is available after harvest for each cluster and recruitment stand.

- Foraging habitat is not fragmented by proposed cutting, but is continuous and contiguous with the cluster, recruitment stand or replacement stand.

- Replacement and recruitment stands are not isolated from respective cluster(s) and adjacent clusters are not isolated from each other by the proposed regeneration cutting.

- The distribution of age classes should ensure an even flow of habitat is available through time.

These requirements and limitations must be met before clearcutting can occur in any MIL.

These are four situations that would meet the above criteria are:

(1) Virginia and pitch pine stands.

The silvical characteristics of Virginia pine and pitch pine make clearcutting the only practical method of regenerating the stand. Virginia pine is shallow rooted, short-lived, and blows down easily if the stand is thinned heavily or opened up. Pitch pine forms branches all along the stem when grown in the open, making the tree unsuitable for RCWs. Both species are intolerant of shading and grow well in full sunlight.

(2) Wet site slash pine.

Slash pine sites which are poorly drained or very wet where high water tables restrict seedling survival and growth can be regenerated by clearcut. Retain six potential cavity trees and or relicts (first priority) per acre. The distribution of the potential cavity trees should not be evenly distributed across the regeneration unit, but in clumps.

(3) Understocked or damaged stands.

Natural regeneration is difficult to achieve in understocked or damaged stands; planting and/or seeding may be necessary. Uneven distribution and low basal area are typical for these stands.

The Forest Service may clearcut these stands if they have fewer than 24 trees 10 inches in diameter or larger. If the existing trees in the stand are desirable for RCW and suitable for the site, the standard mitigation based on MIL would apply. For example, the Forest Service must reserve six trees per acre in an understocked or damaged longleaf stand in a MIL 2 HMA.

If the existing trees are an off-site species and the stand will be regenerated to a more desirable species, the Forest Service must reserve future cavity trees per the direction below for pine restoration sites.

The Forest Service will prioritize these potential cavity trees in all areas to be clearcut, reserving relics first. The reserved trees should be clumped.

(4) Pine restoration sites.

The Forest Service may also clearcut off-site stands which are not understocked or damaged to restore longleaf or other desirable pine species. Pine restoration is described, in detail, on page 54. Where available, six trees per acre and one acre or larger clumps with 40 or more square feet of basal area of the species being restored must be reserved to provide potential cavity trees in the near future. Relict trees of the species being restored would be reserved in clumps, scattered, or a mixture, depending on site conditions.

Even-Aged Silviculture - Seed-tree and Shelterwood

Alternative C would allow seed-tree and shelterwood methods in HMAs classified as **MIL 1 and MIL 2**.

The retention of six relict trees per acre in regeneration areas is optional but encouraged. If relicts are retained, they should be clumped. The trees could be clumped on a per acre basis as shown in Figure 2-C3D. These figures represent an aerial view of a loblolly and longleaf stand.

See pages 65-66 for additional discussion on the seed-tree and shelterwood methods.

Two-aged Silviculture - Irregular Shelterwood

Alternative C would permit use of the irregular shelterwood method in HMAs classified as MILs 3-5.

MIL 3 and MIL 4: Irregular shelterwood would involve several removals. The first removal would leave 40 square feet of pine basal area. See Figures 2-C2B and 2-C3B.

Trees to be retained in the shelterwood seed cut, should be selected in the following order.

(1) relict trees
(2) other potential cavity trees
(3) other trees greater than 10 inches diameter that meet the requirements for seed producers.

Once the new seedlings are established, the seed trees will be removed in a series of partial cuts. The first partial removal should be delayed for 10 years, if silviculturally feasible. At this time the basal area should be reduced to 20-30 square feet of pine per acre. See Figures 2-C2C and 2-C3C.

Subsequent partial removals should maintain a residual pine basal area of 10-20 square feet. Once the new stand of trees is large enough to meet foraging habitat criteria, the parent trees can be reduced to six potential cavity or relict trees per acre. These six trees should be clumped (Figure 2-C3D). Also see Longleaf Pine Exception on page 142.

Figure 2-C2

How a typical loblolly pine stand would appear before and after tree removal using two prescription (2-C1B and 2-C1C) for the irregular shelterwood method.

The small boxes represent and acre of loblolly pine trees viewed from the air.

Figure 2-C2A
A stocked stand, 90 square feet basal area, 24 trees per acre, average diameter of 26 inches.

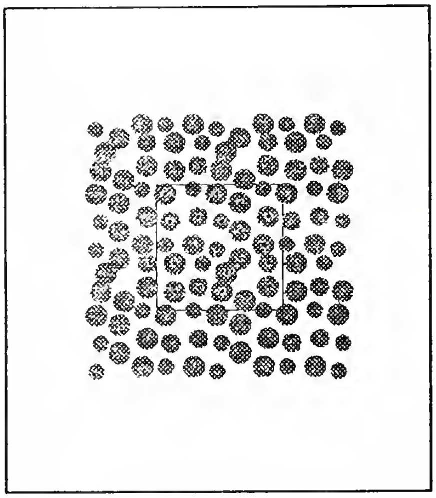


Figure 2-C2B
Prescribed irregular shelterwood seed cut 40 square feet basal area, 11 trees per acre.

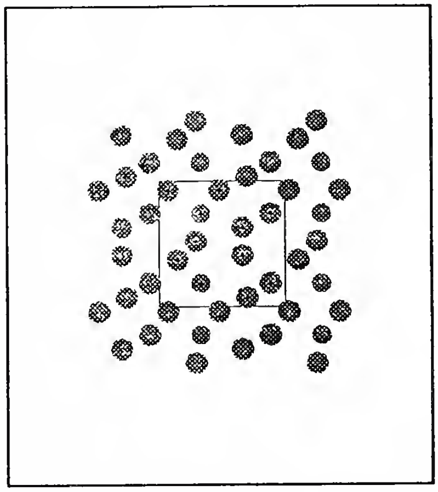


Figure 2-C2C
Prescribed irregular shelterwood seed cut 30 square feet basal area, 8 trees per acre.

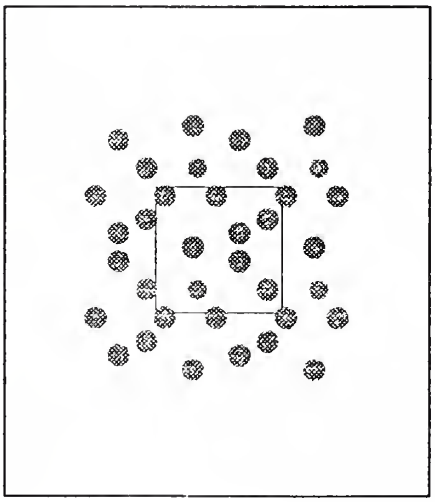


Figure 2-C2D
After final irregular shelterwood overstory removal cut 6 trees per acre, 22 square feet basal area, trees scattered.

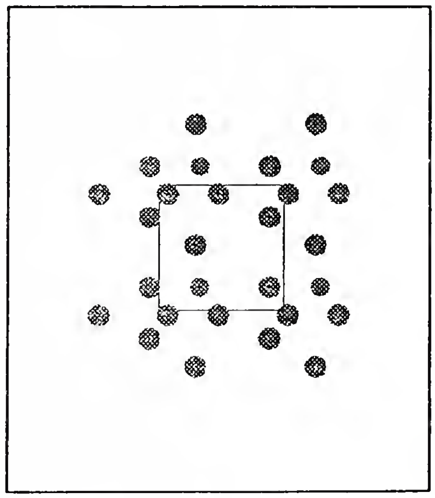


Figure 2-C3

How a typical longleaf pine stand would appear before and after tree removal using two prescription (2-B and 2-C) for the irregular shelterwood method.

The small boxes represent and acre of longleaf pine trees viewed from the air.

Figure 2-C3A
A stocked stand, 75 square feet basal area, 38 trees per acre, average diameter of 19 inches.

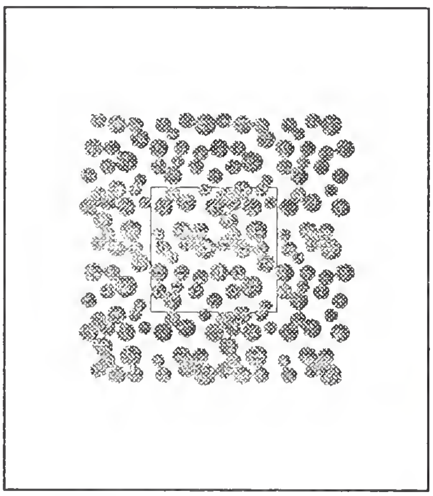


Figure 2-C3B
Prescribed shelterwood seed cut 40 square feet basal area, 20 trees per acre, 6 trees clumped.

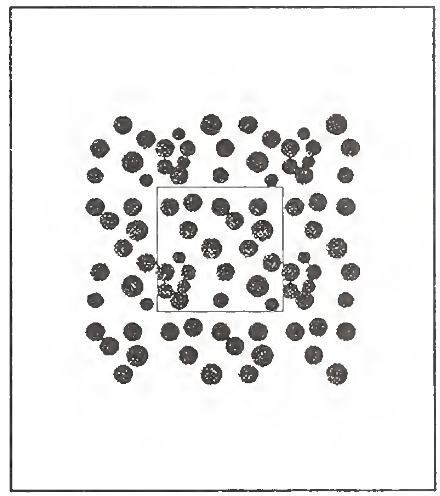


Figure 2-C3C
Prescribed shelterwood seed cut 30 square feet basal area, 15 trees per acre, 6 trees clumped.

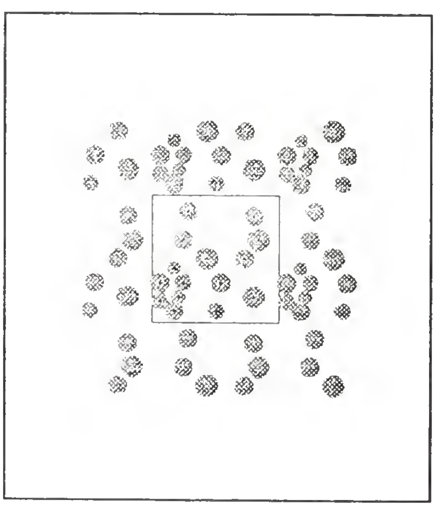
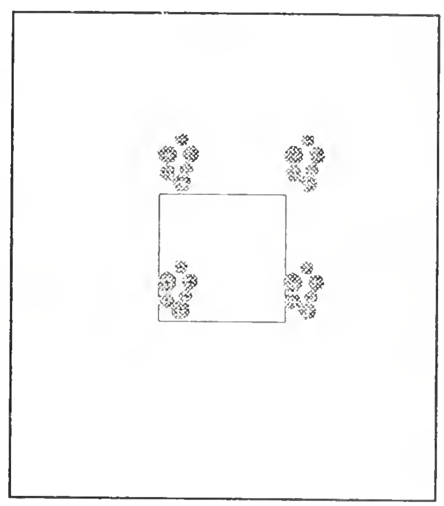


Figure 2-C3D
After final shelterwood overstory removal with 6 clumped trees per acre, 12 square feet basal area.



This strategy maintains an element of foraging habitat on all acres, promotes development of future nesting habitat, provides potential for colonization and reduces the potential for habitat fragmentation.

MIL 5: The irregular shelterwood is used. The pine leave basal area is to be 40 square feet (Figures 2-C2B and 2-C3B).

This MIL represents the smallest RCW populations, those most vulnerable to extirpation. Therefore, the higher leave basal area of shelterwood trees is deemed necessary to help ensure the population's survival. These trees are to remain as long as the RCW population remains in MIL 5.

Trees to be retained as shelterwood should be selected in the following order:

(1) relict trees
(2) other potential cavity trees
(3) other trees >10 inches in diameter that meet the requirements for seed producers.

When the RCW population increases, meeting the criteria to move into MIL 4, the basal area may be reduced to the 20-30 square feet allowed in MIL 4.

Longleaf Pine Exception

Longleaf pine is the most intolerant species of southern yellow pine; its growth and development is inhibited by shading and competition for moisture and nutrients. The number of reserve trees required in MIL 3 through MIL 5 would greatly retard growth of the longleaf seedlings (Boyer 1993).

Alternative C would require leaving the 20 to 30 or 40 square feet of basal area until the longleaf seedlings are well established, and then reduce the overstory to six trees per acre. The final reserve trees would follow the same priority list as other species. The longleaf reserve trees should be clumped to enhance regrowth of the new stand and potential for new clusters (Figure 2-C3D). The longleaf reserve trees would be retained until the HMA was reclassified as MIL 2; if used by the RCW as nest trees they would be retained indefinitely and managed as a cluster. Retention of the longleaf reserve trees once the HMA is reclassified as MIL 2 or 1 is optional, but encouraged.

UNEVEN-AGED SILVICULTURE

Uneven-aged regeneration methods (group and single tree selection) may be used in Alternative C in compliance with Forest Plans. Use of these methods is described previously on pages 69-73.

MONITORING

Monitoring will occur at sufficient intensity to assess accomplishment of guideline objectives of stabilizing RCW population declines and achieving long-term recovery. An RCW cluster status and management needs data base would be established to track cluster status survey results. This system would have sufficient information to track cluster status, cavity use, habitat improvement, treatment accomplishments and needs, cluster habitat conditions, and survey status.

This data base would be used to help settreatment priorities, report accomplishments, identify population trends, and describe response to treatments. Generally, larger populations need less intensive monitoring requirements. Once this monitoring strategy is in place, it would be possible to (1) determine population trends on an annual basis through sequentially observed periodic surveys of compartments (Hooper and Muse 1989), (2) know where all clusters are located, (3) describe extent of single bird groups, (4) ensure protection and management of priority clusters, and (5) determine reproducing population size.

Monitoring intensity would vary by MIL. Two primary monitoring methods would be used; annual cluster checks and cluster location surveys. Following is a description of each method.

Annual cluster checks of active clusters must include roost checks to determine presence of birds and identify single bird groups. These cluster checks should be completed during the nesting season. All active subpopulations should be sampled. Randomly sample at least 20 percent of the active clusters to determine the number successfully fledgling young. Calculate reproducing population size using the technique described by Heckel and Lennartz (personal communication). Stratify sample by subpopulations.

Cluster location surveys would conducted within all suitable but unsurveyed RCW nesting habitat with the objective of identifying all RCW clusters as soon as possible. Suitable RCW nesting habitat includes pine and pine-hardwood (not including white or sand pine) stands 60 years or older (50 years in Virginia pine), or any other stand with sufficient relict pine to support a cluster. For such a survey to be complete, the methodology must ensure that it is not likely that a cluster would be missed--all suitable habitat must be systematically searched for cavity trees.

RCW cluster location information on private or other public lands within 3/4 mile of National Forest lands should be assimilated and included in the FS data base. Responsible agencies should be encouraged to complete surveys, through a cooperative effort, of suitable but unsurveyed RCW habitat on lands adjacent to National Forests (highest priority on those lands within 3/4 mile).

Following are the monitoring guidelines by MIL:

Management Intensity Levels 4 and 5

Conduct cluster checks on all known clusters annually.

Complete cluster location surveys of all suitable RCW nesting habitat within each compartment designated for prescription inventory and evaluation in a given year. Include findings in data base for trend analysis and use as RCW baseline for biological evaluation of proposed activities in respective compartment and as input into the environmental analysis.

Management Intensity Levels 2 and 3

Conduct cluster checks on all active, recently active clusters (survey previous to last was active), and inactive clusters that are within 3 miles of an active cluster annually.

Complete cluster location surveys of all suitable RCW nesting habitat within each compartment designated for prescription inventory and evaluation in a given year. Include findings in data base for trend analysis and use as RCW baseline for biological evaluation of proposed activities in respective compartment and as input into the environmental analysis.

Complete a resurvey of the 1980-82 baseline compartments as soon as possible using the same basic techniques used in original surveys.

Management Intensity Level 1

Conduct cluster checks on all clusters involved in prescriptions involved with proposed projects that could affect RCW, or require cluster management direction. Complete cluster location surveys of all suitable nesting habitat within each compartment designated for prescription inventory and evaluation in a given year. Include findings in data base for trend analysis and use as RCW baseline for biological evaluation of proposed activities in respective compartment and as input into the environmental analysis.

Complete a resurvey of the 1980-82 baseline compartments as soon as possible using the same basic techniques used in original surveys.

SOUTHERN PINE BEETLE HAZARD REDUCTION

Alternative C recommends that thinnings be used to maintain tree vigor and reduce southern pine beetle risk. The Forest Service would thin stands where southern pine beetle hazard was moderate or higher to achieve a minimum 20-25 feet spacing between trees, but maintain an overstory pine basal area of at least 70 square feet per acre. Alternative C would follow the standard Southern Region thinning guides (except for RCW tree selection criteria). The regional thinning guides recommend a range of 60 to 110 square feet of residual pine basal area, depending on site and stand conditions, and the availability of RCW foraging habitat.

Thinning and other means to control southern pine beetle hazard are described in "Managing Southern Forests to Reduce Southern Pine Beetle Impacts" (USDA Forest Service 1986).

HABITAT FRAGMENTATION CONTROL

Alternative C includes the following actions to limit habitat fragmentation potential.

- Extended rotation ages in all MILs.

  The percentage of any HMA in the 0-10 and 0-30 age classes under the new extended rotations will be less than that which Conner and Rudolph (1991a) found to adversely affect the RCW.

- Limitations of habitat disturbing activities within 1/4 mile of RCW groups in MIL 4 and MIL 5.

  The limitations include no regeneration cutting nor clearing of permanent openings. Except that restoration of longleaf pine can occur if the stands to be cut are not needed as nesting habitat in the short-term. Thinnings to enhance RCW habitat are allowed, if other applicable guidelines are met.

- Limiting patch size to an average of 25 acres in MIL 4 and MIL 5.

- The large number of trees which will be retained in all harvest areas in MIL 3 through MIL 5.

CLEARING FOR NONTIMBER MANAGEMENT PURPOSES

The removal or clearing of forest cover for oil/gas exploration, developed recreation sites, creating a lake, etc., may create a permanent loss of RCW habitat. Alternative C prohibits the permanent clearing of potential RCW habitat unless the loss of such habitat would not reduce the capability of the HMA to support its identified RCW population objective.

The Forest Service would evaluate all proposed clearings within HMAs and determine whether they would impact the RCW.

- Clearing would not be allowed if foraging habitat is limited or if the clearing causes a break between the foraging habitat and the cluster or recruitment stand.

- Permanent clearings within 1/4 mile of groups in MIL 4 and MIL 5 should not occur.

Alternative D

SUMMARY - ALTERNATIVE D

Alternative D was developed in response to the issue concerning the effect harvesting timber has on RCW. There will be no sustained production of forest products, although some cutting of trees will be allowed (thinnings and restoration of desirable pine species) to enhance RCW habitat and reduce the risk of insect outbreaks. There will be no rotations established. Five MILs are established.

This alternative would set into motion an immediate and deferred set of actions, each containing various elements. These are described in full detail in this chapter. The current conditions affecting the RCW and environmental effects are described in Chapter 3.

Revised Direction

The Forest Service proposes to revise the Regional Wildlife Habitat Management Handbook, FSH 2609.23R (Handbook), and the Southern Regional Guide to incorporate the revised Handbook. The revised Handbook would provide a new Regional direction for managing the red-cockaded woodpecker and its habitat. This direction would not be implemented until the National Forests with RCW populations have individually amended or revised their Forest Plans. This would occur within one to three years after the signing of the ROD.

Elements of the Proposed Handbook Revision

Alternative D would:

(1) Establish criteria to delineate RCW Habitat Management Areas (HMA) and determine population objectives to ensure demographic stability.

Alternative D is based on delineation of HMAs. The size of the HMAs would be based on the number and distribution of active and inactive clusters that existed in 1986. Each HMA would be classified as one of five management intensity levels (MIL), which are based on the risk of extirpation (local extinction) faced by the RCW population in the HMA. The risk categories are determined by a population's size and trend.

(2) Eliminate sustained yield timber management.

Alternative D would not produce timber products on a sustained yield basis. A sustained flow of RCW habitat through time cannot be assured. Future regeneration of the forest would be dependent on natural seeding in openings created by dead and fallen trees.

(3) Establish Regional Handbook direction for management of the red-cockaded woodpecker and its habitat.

- Emphasize the use of artificial cavities and the moving of RCW from area to area (translocation) to speed population expansion and eventual recovery of the species.

- Emphasize thinning to reduce southern pine beetle risk and enhance RCW habitat.

- o Emphasize prescribed fire, including growing season burns, to control midstory vegetation in the pine and pine-hardwood forest types throughout HMAs, especially within clusters, recruitment stands and replacement stands.

- o Encourage adequate foraging habitat (6350 pine trees greater than 10" diameter, 30 years old or older within 1/2 mile of and connected to the clusters).

- o Allow restoration of desirable pine species, such as longleaf pine, in areas where they occurred historically and would provide better RCW habitat.

- o Monitoring intensity would be determined by Management Intensity Level, which reflects the size and vulnerability of the RCW population.

IMMEDIATE ACTIONS

The immediate action is the same as described in Alternative C, pages 113-114.

DETAILED DESCRIPTION-ALTERNATIVE D

Habitat Management Area Delineation

The establishment and delineation of Habitat Management Areas (HMAs) are an integral part of Alternative D (see additional discussion on page 44). The Forest Service proposes to delineate HMAs for all active RCW populations dependent on National Forest lands (See Figure I-2). The three National Forests that had RCW in the past 20 years, but none at present, would decide whether to develop HMAs and actively manage reintroduced support populations. This decision would be deferred until the forests revise their Forest Plans.

The following is a summary of the HMA delineation process, which is explained in detail in Appendix A.

An individual HMA, tentative or permanent, should include sufficient acres of suitable habitat, foraging and nesting, to support at least 50 RCW groups. Recovery populations should have HMAs large enough to support 500 groups, if the land base will allow. Suitable RCW habitat includes pine and pine-hardwood forest types which have the potential to provide at least minimal RCW foraging habitat.

The delineation of HMAs is a three-step process:

(1) Delineate the historic RCW population.

Consider current and historic cluster distribution, including any clusters on adjacent private land within 18 miles of Forest Service System lands.

(2) Identify isolated subpopulations.

Consult recent surveys which describe the current condition of RCW distribution. Include all groups separated by five miles or less of currently suitable foraging habitat or three miles or less of currently unsuitable foraging habitat. Include all inactive clusters within five or three miles using the above suitability criteria.

(3) Delineate the HMA boundary.

Establish an HMA for all populations having one or more multiple bird groups. Extend the boundary to include subpopulations separated by 18 miles or less of potentially suitable habitat.

Subpopulations separated by three miles or more of permanently unsuitable habitat should be placed in a different HMA. Permanently unsuitable habitat, such as lakes, agricultural lands, riparian hardwood bottoms, is determined by its inherent suitability and traditional use. Private land (inholdings) should neither be automatically excluded or included as suitable RCW habitat.

Extend the HMA boundary at least 1/2 mile and preferably 3/4 mile from the geometric center of clusters to allow the population to expand in any direction, by assuring they would find suitable habitat around those clusters, if land ownership will allow.

Create corridors that are at least 2.5 miles wide, linking isolated subpopulations, if possible. These corridors would ideally approximate the width of the subpopulations' habitat area being linked. Broad corridors allow the RCW from the various subpopulations to colonize the corridor area, which improves effective dispersal and social interaction throughout the HMA.

Delineate the HMA boundary to coincide with administrative, topographic, stand, and compartment boundaries for ease of administration.

Extend the HMA boundary beyond Forest Service System lands to include suitable habitat on adjacent public lands only where a Memorandum of Understanding (MOU) has been signed for the purpose of joint RCW management. For example: The Oconee National Forest and adjacent Hitchiti Experimental Forest have a joint agreement with the USDI-FWS, Piedmont National Wildlife Refuge.

Delineate the HMA boundary to exclude wildernesses, unless they have a wilderness management plan which allows prescribed burning and midstory control, essential management practices for maintenance of RCW habitat. All forests having essential RCW groups within a wilderness which is predominately longleaf pine are encouraged to develop such plans.

Appendix D includes maps identifying tentative HMAs for all active RCW populations on National Forest land.

Delineation of Tentative HMA Boundaries

Full implementation of the new Regional RCW management direction may be delayed for two or more years due to the time necessary to complete Forest Plan revision/amendments.

Interim S&Gs currently protect 3/4-mile radius circles around existing active and inactive clusters, but do not affect habitat outside the circles which would become part of the permanent HMA.

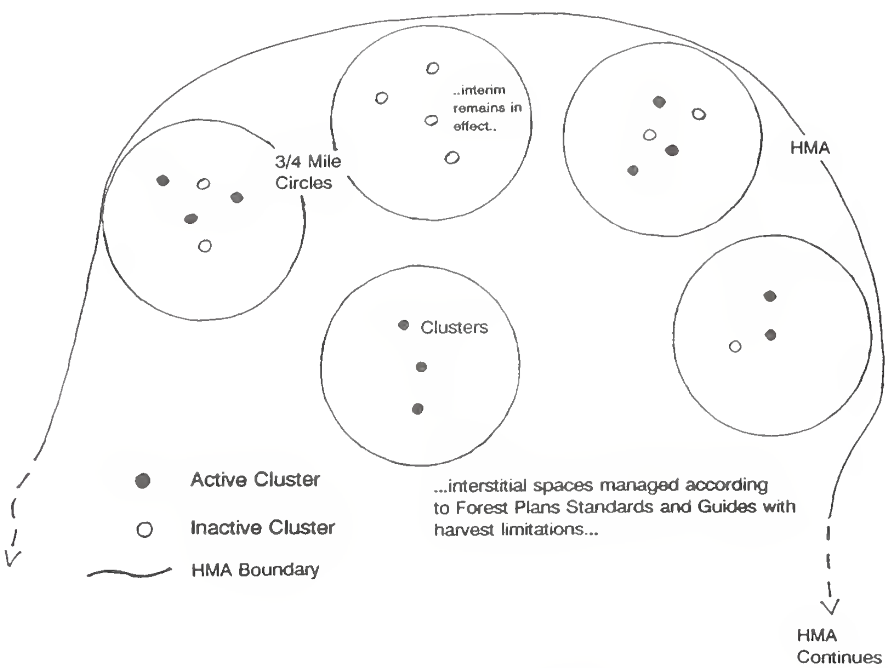
The interdisciplinary team concluded that immediate action was necessary to maintain future management options within the proposed HMA.

The interdisciplinary team feels it is essential to identify tentative HMAs immediately. This immediate action would allow thinnings, two-age or uneven-aged silviculture, which retain relatively high basal areas and canopy cover. The maintenance of this number of trees allows a wider range of silvicultural options in the future. Clearcutting would also be allowed to restore pine species more desirable to the RCW, particularly longleaf and shortleaf pine. If a Forest chooses to being restoration during the transition period between the signing of the ROD and their Forest Plan amendment or revision, the Forest must first identify sufficient recruitment stands and foraging habitat to meet their tentative population objective identified in Table 2-D1. These limitations apply to the areas within the tentative HMA but outside the 3/4-mile radius circles. Forest Plan rotations and allowable sale quantities, etc., within these areas, will not be changed at this time. Any such changes will occur when the individual Forest Plans are revised/amended.

Tentative HMAs would be delineated using the process summarized on the preceding page and detailed in Appendix A. The boundaries would be finalized as a part of the Forest Plan amendment/revision to incorporate the new Regional RCW management direction. Figure 2-D1 illustrates how the tentative HMA strategy would appear when implemented on the ground.

Figure 2-D1
Tentative HMA Diagram

The proposed action would prescribe RCW management activities within tentative HMAs and outside of the 3/4-mile circles.



Setting Population Objectives

The Forest Service proposes to establish a population objective for each HMA. Population objectives are determined after the HMA has been delineated and are based on the area of suitable RCW habitat within each HMA. Appendix A presents a detailed description of this process.

The Fish and Wildlife Service determined a recovered population should have at least 250 groups annually fledgling young (reproducing population). In the absence of population-specific reproductive data, a population objective of 500 active clusters should be used. If the land base allows, recovery populations will be managed to sustain 500 active clusters or a reproducing population of 250. Support populations would be managed for a minimum of 50 groups; however, most support populations will have population objectives well above this minimum. Table 2-D1 lists the tentative population objective for each RCW population.

The acreage needed to support a single RCW group varies by physiographic province. For example: Habitat quality in the lower Coastal Plain is usually very high; therefore, a density objective of one group per 200 acres of suitable habitat will be used. Habitat quality in the Piedmont is lower, so a density objective of one group per 300 acres will be used.

Table 2-D1

Tentative Habitat Management Areas (HMA) and Population Objectives.

Tentative HMAs are based on the distribution of existing active and inactive clusters (colony sites) rather than the current RCW population.

STATE	National Forests with HMAs (RECOVERY POP. UND)	Tentative HMA Area (Acres)	Population 1994 (Active Clusters)	Tentative Pop. Objective (Active Clusters)
ALABAMA	Bankhead	20,402	0	68
	Conecuh	61,817	14	309
	Talladega-Oakmulgee Rd	98,584	120	394
	Talladega/Shoal Creek Rd	124,247	4	413
		305,050	138	1,184
ARKANSAS	Ouachita	68,521	15	228
FLORIDA	Apalachicola-			
	Apalachicola RD	141,263	500	706*
	Wakulla RD	144,368	150	722*
	Ocala	48,400	4	242
	Osceola	98,183	45	462
		432,214	699	2,132
GEORGIA	Oconee/Hitchiti **	52,966	16	176**
KENTUCKY	Daniel Boone	48,487	3	66
LOUISIANA	Kisatchie-			
	Catahoula RD	65,734	27	328
	Evangeline RD	46,298	52	231
	Kisatchie RD	59,267	69	296
	Vernon RD	64,243	186	321
	Winn RD	56,297	18	281
		291,839	352	1,457
MISSISSIPPI	Bienville	125,160	92	500
	DeSoto-			
	Biloxi RD	38,293	5	191
	Black Creek RD	35,467	1	177
	Chickasawhay RD	100,494	4	502
	Homochitto	67,755	27	225
		367,169	129	1,595
N.CAROLINA	Croatan	27,940	55	139
S.CAROLINA	Francis Marion	125,351	371	625*
TENNESSEE	Cherokee	6,150	1	n/a
TEXAS***	Angelina/Sabine	66,286	42	329
	Davy Crockett	65,016	38	325
	Sam Houston	105,194	149	525
		236,496	229	1,179
SOUTHERN REGION		1,962,183	2,008	8,781

* These populations can be declared recovered (MIL1) when they reach 500 active clusters and meet all other criteria needed for recovery.

** The Oconee NF is combined with Hitchiti Experimental Forest and Piedmont National Wildlife Refuge by Memorandum of Understanding (FSM 2609.23). The figures listed, however, show only the National Forest acreage and population objectives.

*** The National Forests in Texas are currently managed under a court order, which will remain in effect until the order is removed or a new order issued by the District Court.

Management Intensity Levels

Establishment of MILs is a key element of Alternative D (see additional discussion on pages 44-46.

Two sets of MIL classification criteria were developed--one set for populations with a land base large enough to support 500 groups and another set for populations with inadequate acreage to support 500 groups. Tables 2-C2 and 2-C3 in the description of Alternative C show the MIL breakdown for these two situations, respectively.

Alternative D does not provide for a sustained flow of forest products. Therefore, the primary use of MIL's will be to determine the level of direct RCW management.

Establishment of Subhabitat Management Areas

The establishment of sub-HMAs is not a management option in Alternative D.

PROTECTION OF CLUSTERS, REPLACEMENT, AND RECRUITMENT STANDS

The Forest Service proposes to incorporate the following standards and guidelines into the revised Handbook to ensure RCW clusters, recruitment stands, and replacement stands (described on page 46) are not adversely affected by other forest management activities.

Cutting

All alternatives would prohibit timber harvest, cutting or killing of trees within clusters, recruitment stands, and replacement stands except where those actions would protect or improve RCW habitat. Snags or other dead trees would not be removed unless they posed a threat to public safety.

The alternatives would prohibit cutting of cavity trees in active and inactive clusters unless they posed a threat to public safety or to protect the cluster, recruitment stand, and replacement stand from insect attack. The Fish and Wildlife Service shall be consulted and issue a concurrence before any cavity tree would be cut.

Motorized, Heavy Equipment, and Concentrated Human Use Areas

Alternative D requires habitat improvement projects involving motorized or heavy equipment to include sufficient project administration and/or contract language to protect the cluster, recruitment stand, and replacement stand, especially cavity trees and potential cavity trees.

These alternatives would prohibit concentrated equipment use, such as log decks, pine straw bailing operations, off-road vehicle trails, trail heads, and camp sites within clusters, recruitment stands and replacement stands.

The Forest Service will relocate or modify existing uses and activities if they are found to adversely affect the RCW.

Cavity Tree Protection During Prescribed Burning Operations

All alternatives encourage prescribed burning to control midstory vegetation for the benefit of the RCW, but require the burning prescription and cycles to minimize risk to cavity trees.

Cavity trees may be protected by raking away or back burning adjacent fuels. Plow lines will be excluded from clusters unless needed to protect the cavity trees during an emergency.

Nesting Season Disturbance

The Forest Service would require that all potentially disturbing activities within the cluster be scheduled before or after the nesting season. The general nesting season dates will be used unless the specific group's nesting season is documented and monitored to account for individual variation.

The Forest Service would also restrict its habitat improvement activities within clusters during the nesting season, unless such activity during the nesting season is necessary for the continued survival fo the RCW group. An exception to this limitation is prescribed burning.

Construction of Rights-of-Way

Alternative D would prohibit all construction of linear rights-of-way, such as roads, power lines, or pipelines within a cluster, recruitment stand, or replacement stand.

Existing Rights-of-Way Reconstruction/Maintenance

Alternative D would allow reconstruction or maintenance of existing roads through clusters, recruitment stands, and replacement stands if detailed study shows such activities will not adversely affect RCW and the activities are scheduled before or after the nesting season.

Road and right-of-way reconstruction/maintenance through cluster will be closely monitored to ensure protection of cavity trees and potential cavity trees. Light maintenance of high standard open roads, such as road grading or mowing of the rights-of-way, which are no more disturbing than the passage of normal traffic, will be allowed during the nesting season.

Southern Pine Beetle Suppression

The Forest Service will attempt to minimize the impact of southern pine beetle to cavity trees and foraging habitat. When RCW clusters, recruitment stands, and replacement stands are threatened by southern pine beetles, a biologist and entomologist would recommend a course of action before taking control measures.

The Southern Pine Beetle Record of Decision (USDA-FS, 1987, p. 33) sets standards and guidelines for protecting both cavity trees and the RCW during control operations.

- Prohibits cutting of trees already vacated by beetles unless they pose a threat to public safety.

- Allows cutting of inactive or relict cavity trees, if infested, within a designated treatment buffer zone only to protect the rest of the cluster.

- Allows cutting of uninfested trees within 200 feet of a cavity tree only to protect cavity trees.

- Prohibits salvage operations during nesting season.

- Allows only minimal disturbance, such as cutting or chemical treatment, if necessary to protect the cavity trees during nesting season.

- Prohibits piling and burning of slash and spraying standing trees within clusters.

Alternative D considers wilderness RCW groups essential to recovery. As such, southern pine beetle control will occur in wildernesses to protect these groups as discussed in the Final Environmental Impact Statement for the Suppression of the Southern Pine Beetle, following the criteria established in the Record of Decision for that document (USDA Forest Service 1987). The Record of Decision stated only essential groups and their foraging habitat would be protected. The criteria that triggers initiation of control action are the southern pine beetle infestation must be within 1/2 mile of an essential group, adverse effects are likely to occur within the next 30 days, and the continued existence of the group is in question.

MANAGEMENT OF CLUSTERS, REPLACEMENT, AND RECRUITMENT STANDS

The Forest Service proposes to actively manage the RCW clusters, recruitment stands, and replacement stands to ensure continued viability and population growth.

Marking Cavity Trees and Cluster Boundaries (Monumentation)

All alternatives require the marking of cavity trees to reduce the risk of accidental damage. The Forest Service needs to know where the cavity trees are located on-the-ground to consistently apply the protective standards and guidelines and monitor the cluster.

The Forest Service will mark all active and inactive cavity trees, check and update whenever a cluster is visited. Cluster boundaries must be marked for easy recognition, but the marking may be temporary (signs) instead of permanent (paint). The marking of cavity trees and cluster boundaries must be updated when a project that would alter the habitat, such as timber harvest or road construction, is planned within 1/4 mile of a cluster (active and inactive).

Cluster Status - Data Base Management

All alternatives would recognize and require tracking of six cluster status categories (active, inactive, abandoned, historic, destroyed and invalid) which are defined in the glossary.

The Forest Service will maintain and update a data base which includes status category of all RCW clusters within the HMAs. The data base will link monitoring and survey data and show areas where replacement and recruitment stands are necessary.

Cavity trees will be preserved in all cluster categories, but special cluster management is not required for abandoned, historic, destroyed, or invalid clusters unless identified as recruitment or replacement stands.

Changes in cluster status should be tracked and the data base updated annually. Active clusters may be declared inactive if no RCWs are living in them. Table 2-D2 shows when an inactive cluster may be declared abandoned if not identified as a recruitment or replacement stand.

Table 2-D2
Abandoned Cluster Timetable
Inactive clusters in MIL 2 through MIL 4 with declining populations and all MIL 5 populations cannot be declared abandoned.

MIL	Population Trend	Minimum Time (Years)
1	Stable or Increasing	5
2	Stable or Increasing	10
2	Decreasing	n/a
3	Stable or Increasing	10
3	Decreasing	n/a
4	Stable or Increasing	10
4	Decreasing	n/a
5	Any Trend	n/a

n/a: Cannot be abandoned

Recruitment Stands

Alternative D would establish recruitment stands in each HMA where the population objective exceeds the current RCW population. Recruitment stands are optional in MIL 1 and MIL 2. The number of recruitment stands should equal the HMA population objective minus the number of groups and existing recruitment stands in that HMA.

The selection criteria include:

- Nesting suitability considering stand age, forest type, and availability of relicts.

  The oldest available stands or younger stands with sufficient relicts should be selected. Inactive clusters may also be designated as recruitment stands. Midstory control should be completed and recruitment stands may be improved by installing artificial cavities.

- Distance to a cluster.

  Recruitment stands should lie within 1/4 mile to 3/4 mile from a cluster or other recruitment stands to ensure good spatial distribution and increase probability of colonization.

- Must have adequate suitable foraging habitat connected to the cluster or recruitment stand.

- Clusters inside wilderness.

  Recruitment stands for RCW groups living in wilderness should be located outside the wilderness boundary. This action would encourage the RCW population to extend itself away from the wilderness into the HMA where the clusters can be managed for its benefit. Wildernesses are excluded from HMAs unless the specific wilderness management plan can accommodate RCW management.

- Clusters on private land.

  Recruitment stands should be established for RCW groups living on adjacent private lands within 3/4 mile of Forest Service System lands. These stands should be located on National Forest lands as close to the cluster as possible. This action would encourage the RCW to move to Forest Service lands where cluster management can take place.

Replacement Stands

Alternative D would establish replacement stands, which are crucial for sustaining populations, for all active clusters. These stands would replace existing clusters as their cavity trees die. Replacement stands are optional in MIL 1 and MIL 2. A replacement stand will be selected for all nonwilderness and essential wilderness groups.

The selection criteria include:

- Nesting suitability considering stand age, forest type, availability of relicts.

  Inactive clusters may be designated as replacement stands.

- Distance to a cluster.

  A replacement stand should be adjacent to the cluster if possible, and no more than 1/2 mile from it.

- Clusters within wilderness.

  Replacement stands for essential RCW groups living in wildernesses should be established as close to the cluster as possible, but located outside the wilderness boundary.

- Clusters on private land.

  Replacement stands would not be established adjacent to clusters on private lands until the group had moved onto National Forest land.

Midstory Vegetation Control

Alternative D would require midstory removal and control be completed in all clusters, recruitment stands and replacement stands outside of wildernesses and should be completed for all essential wilderness groups (see additional discussion on page 47).

The Forest Service will do midstory control over the entire stand, at least 10 acres for each cluster. The treatment should eliminate all hardwood midstory trees within a 50-foot radius of all active and inactive cavity trees. Total basal area of hardwoods should be less than 20 square feet.

Pine midstory should be controlled before the trees block access to cavity trees, potential cavity trees, and line-of-sight between them. Evaluate the need to remove obstructing dominant and codominant pine and hardwood stems, within 50 feet of cavity and potential cavity trees.

The treatment should eliminate all hardwood midstory trees within the stands.

Dominant and codominant hardwoods should be removed, unless a site-specific analysis indicates their removal would decrease the suitability of the stand for RCW. At no time should more than 20 square feet of basal area of dominant and codominant hardwoods be retained within the cluster.

In areas where cluster, recruitment stand or replacement stand boundaries may include natural hardwood areas, such as stream bottoms, no treatment should occur to eliminate hardwoods or to control midstory within the natural hardwood area unless absolutely necessary to maintain the viability of the RCW group.

Outside clusters, but within the HMA, the reduction of hardwood midstory is encouraged in the pine and pine-hardwood forest types. The objective is improvement of foraging habitat. Prescribed burning will be the primary tool to accomplish this objective.

Prescribed burning is generally the best way to control midstory vegetation, especially small hardwoods. The RCW prefers an open park-like forest which can be maintained by underburning every two to five years. Burning regimes should mimic the naturally occurring fires which maintained these areas in presettlement times.

Emphasis should be placed on growing season burning, especially in those habitats which were naturally maintained by growing season fires: longleaf pine/wiregrass, longleaf pine/bluestem and shortleaf pine/bluestem. This would approximate natural conditions historically prevalent in these habitats.

The Forest Service will prioritize and schedule maintenance burns for those clusters having already received initial treatment to eliminate midstory. Maintenance would receive priority to ensure previous investments in initial midstory control are not lost.

Artificial Cavities

Artificial cavities and their role in the recovery of the RCW have been previously described on pages 47-51. Alternative D would require artificial cavities in MIL-2 through MIL-5 and recommend additional start holes for higher risk populations as shown in Table 2-D3.

The Forest Service will use the procedures and methods specified by Taylor and Hooper (1991) and Allen (1991) to construct or install artificial cavities in suitable trees. Only individuals experienced in the respective techniques should install artificial cavities. Midstory vegetation must be controlled in conjunction with installation of artificial cavities. The Forest Service would prioritize and schedule installations to provide cavities where they are needed most.

The following priorities will be used:

(1) Active clusters with a single cavity tree.

(2) When needed to support translocation efforts.

(3) Active clusters with fewer than four usable cavities.

(4) Inactive clusters with fewer than four usable cavities within one mile of an active cluster.

(5) Recruitment stands within one mile of an active cluster.

(6) Inactive clusters with fewer than four usable cavities within three miles of an active cluster.

(7) Recruitment stands within three miles of an active cluster.

(8) Inactive clusters or recruitment stands more than three miles from an active cluster.

As the priorities imply, artificial cavities should first be installed in or very near active clusters and then progressively move to stands farther away.

Table 2-D3
Artificial Cavity Requirements

Drilled start holes are recommended in MIL 3 through MIL 5 in addition to completed drilled cavities or cavity inserts.

MIL	Artificial Cavities	Specified Type
1	Optional	As appropriate
2	Required	As appropriate
3	Required	Complete cavities plus >2 start holes
4	Required	Complete cavities plus >2 start holes
5	Required	Complete cavities plus >2 start holes

Reducing Cavity Competition

Cavity restrictors are metal plates with an oblong hole large enough for the RCW (generally 1-3/4" by 2-3/4" as shown in **Figure 2-3**). Cavity restrictors are placed around cavity entrances to prevent other birds (especially pileated and red-bellied woodpeckers) and mammals from enlarging them and displacing the RCW (Carter et al. 1989). Limited cavity availability in some areas, has adversely affected the RCW. Cavity competiton can be minimized by the following:

- Ensure that each group has at least four functional cavities through use of restrictors and/or artificial cavities.

- Within 1/2 mile of active RCW clusters and inactive clusters or recruitment stands that have been made suitable for augmentation, retain uninfested/SPB vacated single dead trees. Within 1/4 mile of inactive RCW clusters which are not suitable for augmentation, retain uninfested/SPB vacated single dead trees. In SPB spots one acre or larger in size, retain six vacated sawtimber trees per acre, if available, two of which should be the larger vacated trees.

  In SPB spots less than one acre, retain two larger vacated sawtimber trees, if available. Preliminary research suggest presence of snags with cavities in and near clusters may reduce competition for RCW cavities (Kappes 1994). This does not preclude salvage of dead trees from large areas resulting from insect outbreaks, hurricanes, tornadoes, or other catastrophic occurences.

- Maintain adequate levels of midstory control. This creates an unsuitable habitat condition for some cavity competitors.

- Install squirrel and snake excluder devices (non-lethal) as needed (Montague and Neal 1995, Withgott et al. 1995).

Cavity restrictors should be placed on enlarged RCW cavities and on unenlarged cavities where experience shows cavity enlargement is likely. The highest priority is active clusters which have a single cavity tree followed by single bird groups, then those clusters with 2 to 4 suitable cavities, and 5 to 8 cavities.

All artificial cavities should be fitted with restrictors when installed.

Restrictors should not be used on cavities which have been enlarged internally to the point of being unusable by RCW.

The Forest Service will monitor cavity restrictors to ensure proper installation and acceptance by the RCW.

Cavity restrictors and their role in the recovery of the RCW have been previously described on pages 51-52. Alternative D requires the use of restrictors, where needed, in MIL 2 through MIL 5, and in MIL 1 if warranted by the particular site-specific conditions.

Translocation

Translocation of RCW and its role in the recovery of the RCW have been previously described on pages 52-53.

The Forest Service will develop priorities and schedule translocation of RCW to best achieve the desired objectives. Priorities are usually based on the spatial distribution of existing groups and the probability of natural dispersal of juvenile RCWs being successful. Any single bird group could be a candidate for augmentation with a juvenile of the appropriate sex.

However, if a single bird group is more than a mile from another group containing a breeding pair it would be a higher priority than a single bird group which had four or more breeding groups within the same mile distance. This is because the RCW in the second example has a much higher probability of receiving a new mate through natural dispersals than does the one which is far removed from a breeding group.

The priorities for reintroduction of RCW groups varies by management objective. If the technique is being used to expand an existing population, the priorities would be similar to those above for augmentation. It is also suggested this method not be used until all single bird groups in the population have been augmented.

If the management objective is the reestablishment of RCW into currently unoccupied habitat, those areas known to have held RCW since 1970 should be first priority.

The translocation of RCW within populations/subpopulations is encouraged. The short distances birds must be moved and the often similarity of the habitat may increase the probability of successful pairings. If translocations between populations are necessary, it is desirable to move birds between areas that are of similar latitude, elevation and forest type.

The planned translocation of RCW will be required to maintain the genetic viability of populations with a reproducing population of less than 250. The effectiveness of such translocations will depend on the number of RCW moved to a specific population and the genetic makeup of these birds in relation to the receiving population. Such genetic exchanges can be through normal subadult augmentation.

The objective is to identify all single bird groups and move an appropriate sex juvenile bird to it, in an effort to create a breeding pair. Priority should be given to single bird groups in RCW populations with fewer than 50 active clusters.

HABITAT MANAGEMENT WITHIN HMAs

The area within HMAs and outside of cluster, recruitment stand and replacement stand boundaries would be managed for a full range of multiple uses, except the sustained yield of timber products.

Prescribed Burning

The Forest Service should annually prescribe burn approximately 490,000 acres on HMAs throughout the Region. The Forest Service would emphasize prescribed burning during the growing season, where appropriate. See additional discussion on pages 53-54.

Pine Restoration

The restoration of longleaf or other desirable pine species is the only regeneration allowed in Alternative D. Once all sites which qualify for restoration are completed, there will be no more planned regeneration of forest stands. The rate of restoration will be controlled to prevent future age class imbalance and reduce potential for habitat fragmentation. Therefore, in some HMAs it may take 30 to 50 years to complete all restoration work.

As important as restoring desirable pine species is to the long-term survival and recovery of the RCW, it is important to schedule pine restoration to minimize any age class bulges in the pine type age class distribution. The Forest Service would base the rate for pine restoration on a 100-year rotation. This would limit the area which could be restored each decade to 10 percent of the area occupied by off site pine species.

For example: A HMA contains 30,000 acres of slash pine growing on longleaf site. Ten percent or 3000 acres could be harvested and restored to longleaf each 10-year period. At this rate it would take 100 years to accomplish all restoration.

The rate of restoration could be accelerated if the off site species is not considered foraging habitat (averages less than 10 inches diameter). Such accelerated restoration would require written approval from the Forest Service Southern Regional Office.

Any restoration planned within 1/4 mile of an active cluster in a population in MIL 4 or MIL 5 would be preceded by a site-specific analysis to ensure the stand being harvested is not needed as foraging or nesting habitat in the short-term. See additional discussion on page 54.

Foraging Habitat Management

Alternative D would provide adequate foraging habitat as described on pages 54-56.

The Forest Service would evaluate foraging habitat within 1/2 mile of clusters and recruitment stands when pine tree removal is planned to ensure adequate foraging habitat is available after any harvest. Procedures described in the Fish and Wildlife Service Blue Book (USDI-FWS 1989) will be followed.

Hooper and Lennartz (1995) suggest there may be some circumstances when a RCW population would benefit in the long-term by having its foraging habitat reduced below 6350 stems. Some examples of such circumstances are: (1) in the thinning of pine stands to reduce the risk of southern pine beetle infestation (Thatcher et al. 1986); (2) in the removal of trees infested with southern pine beetles in order to avoid a major outbreak (Billings and Varner 1986).

The Forest Service's goal is to provide the highest quality foraging habitat, rather than large areas of poor habitat. Thinning within RCW foraging habitat should maintain at least a 70-square feet of pine basal area. Where foraging habitat is limited, the Forest Service will make thinning stands less than 10 inches diameter within 1/2 mile of the cluster (closer to the cluster the better) a priority action. This action helps these trees grow faster and shortens the time required for these stands to become suitable foraging habitat. The Forest Service will use standard silvicultural prescriptions for thinning young stands.

The Forest Service must provide 100 percent of the foraging habitat equivalents for RCW groups whose 1/2 mile foraging zone extends onto another ownership (private, state, or other Federal) without a cooperative agreement with the non-Forest Service landowner.

The Forest Service will provide its proportional share of foraging for RCW groups on adjacent private, state, or other federal ownership but within 1/2 mile of National Forest land, if no cooperative agreement with the non-Forest Service landowner exists.

The cooperative RCW agreement is a contract that ensures adherence to the Fish and Wildlife Service foraging habitat procedures. This ensurance would allow foraging habitat equivalents to be shared in proportion to their availability between the Forest Service and adjacent landowner or agency.

Future Nesting Habitat

Alternative D does not include planned regeneration of forest stands. Therefore, the sustained production of potential cavity trees cannot be ensured over the long-term (hundreds of years).

Conner and Rudolph (1995) suggest potential cavity trees need a minimum of 5 inches, and preferably 7-8 inches, of heartwood at cavity height to support a cavity. The presence of heartrot is also very desirable in potential cavity trees, as the RCW shows a strong preference for trees infected with this wood-decaying fungus. Alternative D has no established rotation age; therefore, over the next 50-100 years, there will be an abundance of trees meeting and exceeding these criteria. However, because there is no planned regeneration of forest stands, a sustained flow of such trees cannot be ensured over the long-term.

Because few existing trees are old enough to become cavity trees, thinning of overstory pine trees is an important activity to enhance or protect potential RCW nesting habitat. Thinning increases the distance between trees and thus reduces the risk of southern pine beetle infestations. Thinning also increases the openness of stands too dense for optimal RCW nesting habitat. Thinning of mature stands for these purposes are allowed in Alternative D.

Once the restoration of longleaf and other desirable pine species is completed, the management of the entire HMA will be very similar to that prescribed previously for clusters, recruitment stands and replacement stands. See additional discussion on pages 56-57.

Thinning

Thinning of forest stands is a key activity in the production of good RCW habitat and is an important element of Alternative D (see pages 57-59).

Thinning of mature stands to enhance RCW habitat will vary depending on stand age. Stands between the ages of 30 and 70 will be managed primarily as foraging habitat.

Use the following guidelines:

- Maintain pine basal area of 60-110 square feet depending on site quality.

- If total pine basal area exceeds 100 square feet, do not remove more than 30 square feet of basal area in any single thinning operation.

- The priority for selecting pine trees to remain in all MILs are:

  (1) relict trees
  (2) other potential cavity trees
  (3) trees greater than 10 inches diameter that are not potential cavity trees
  (4) trees less than 10 inches diameter

As stands become suitable as potential cavity trees, 70 years old and older, the following thinning guidelines will be used:

- Maintain pine basal area between 60 and 80 square feet.

- Ensure proper spacing to reduce southern pine beetle risk, 20-25 feet or more.

- Priority for selecting pine trees to remain are the same as above.

REGENERATION AND SUSTAINING RCW HABITAT

Trees, like all living things, do not live forever. In natural stands, trees die and new seedlings from nearby seed sources grow in the area opened to the sunlight. These natural openings in which the new trees grow, range in size from a fraction of an acre (due to the death of a single tree) to many acres (due to some catastrophic occurrence).

Alternative D will depend primarily on natural forces and processes to regenerate the forest. As previously described, the only planned regeneration will be that associated with the restoration of longleaf or other desirable pine species previously described on pages 54 and 161. The only other commercial harvest of timber will be thinnings to enhance RCW habitat and to reduce risk of southern pine beetle infestations.

Salvage of timber lost to catastrophic events such as wind storms, hurricanes, etc., would be considered and allowed on a case by case basis. Such salvage often reduces the risk of insect outbreaks and potential for catastrophic fires. Appropriate National Environmental Policy Act and Endangered Species Act compliance would be required prior to such activities.

MONITORING

Monitoring will occur at sufficient intensity to assess accomplishment of guideline objectives of stabilizing RCW population declines and achieving long-term recovery. An RCW cluster status and management needs data base would be established to track cluster status survey results. This system would have sufficient information to track cluster status, cavity use, habitat improvement, treatment accomplishments and needs, cluster habitat conditions, and survey status. This data base would be used to help set treatment priorities, report accomplishments, identify population trends, and describe response to treatments.

Generally, larger populations need less intensive monitoring requirements. Once this monitoring strategy is in place, it would be possible to (1) determine population trends on an annual basis through sequentially observed periodic surveys of compartments (Hooper and Muse, 1989), (2) know where all clusters are located, (3) describe extent of single bird groups, (4) ensure protection and management of priority clusters, and (5) determine reproducing population size.

Monitoring intensity would vary by MIL. Two primary monitoring methods would be utilized; annual cluster checks and cluster location surveys. Following is a description of each method.

Annual checks of active clusters must include roost checks to determine presence of birds and identify single bird groups. These cluster checks should be completed during the nesting season. All active subpopulations should be sampled. Randomly sample at least 20 percent of the active clusters to determine the number successfully fledgling young. Calculate reproducing population size using the technique described by Heckel and Lennartz (in press). Stratify sample by subpopulations.

Cluster location surveys should be conducted within all suitable but unsurveyed RCW nesting habitat with the objective of identifying all RCW clusters as soon as possible. Suitable RCW nesting habitat includes pine and pine-hardwood (not including white or sand pine) stands 60 years or older (50 years in Virginia pine), or any other stand with sufficient relict pine to support a cluster.

For such a survey to be complete, the methodology must ensure that it is not likely that a cluster would be missed–all suitable habitat must be systematically searched for cavity trees.

RCW cluster location information on private or other public lands within 3/4 mile of National Forest lands should be assimilated and included in the Forest Service data base. Responsible agencies should be encouraged to complete surveys, through a cooperative effort, of suitable but unsurveyed RCW habitat on lands adjacent to National Forests (highest priority on those lands within 3/4 mile).

Following are the monitoring guidelines by MIL:

Management Intensity Levels 4 and 5

Conduct cluster checks on all known clusters annually.

Complete cluster location surveys of all suitable RCW nesting habitat within each compartment designated for prescription inventory and evaluation in a given year. Include findings in data base for trend analysis and use as RCW baseline for biological evaluation of proposed activities in respective compartment and as input into the environmental analysis.

Management Intensity Levels 2 and 3

Conduct cluster checks on all active, recently active clusters (survey previous to last was active), and inactive clusters that are within 3 miles of an active cluster annually.

Complete cluster location surveys of all suitable RCW nesting habitat within each compartment designated for prescription inventory and evaluation in a given year. Include findings in data base for trend analysis and use as RCW baseline for biological evaluation of proposed activities in respective compartment and as input into the environmental analysis.

Complete a re-survey of the 1980-82 baseline compartments as soon as possible using the same basic techniques used in original surveys.

Management Intensity Level 1

Conduct cluster checks on all clusters involved in prescriptions involved with proposed projects that could affect RCW, or require cluster management direction. Complete cluster location surveys of all suitable nesting habitat within each compartment designated for prescription inventory and evaluation in a given year. Include findings in data base for trend analysis and use as RCW baseline for biological evaluation of proposed activities in respective compartment and as input into the environmental analysis.

Complete a re-survey of the 1980-82 baseline compartments as soon as possible using the same basic techniques used in original surveys.

SOUTHERN PINE BEETLE HAZARD REDUCTION

Alternative D recommends that thinnings be used to maintain tree vigor and reduce southern pine beetle risk. The Forest Service would thin stands where southern pine beetle hazard was moderate or higher to achieve a minimum 20-25 feet spacing between trees, but maintain an overstory pine basal area of at least 70 square feet per acre. Alternative D would follow the standard Forest Service Southern Region thinning guides (except for RCW tree-selection criteria). The Regional thinning guides recommend a range of 60 to 110 square feet of residual pine basal area, depending on site and stand conditions, and the availability of RCW foraging habitat.

Thinning and other means to control southern pine beetle hazard are described in "Managing Southern Forests to Reduce Southern Pine Beetle Impacts" (USDA Forest Service 1986).

HABITAT FRAGMENTATION CONTROL

The only potential for habitat fragmentation due to regeneration cutting in Alternative D would be due to restoration of desirable pine species. This activity will be limited by restricting the area that can be restored each decade based on a 100-year rotation (this would allow 10 percent of the area to be restored per decade). Fragmentation could occur as the result of catastrophic events, i.e., hurricanes, tornados, insect outbreaks, etc.

CLEARING FOR NON-TIMBER MANAGEMENT PURPOSES

The removal or clearing of forest cover for oil/gas exploration, developed recreation sites, creating a lake, etc., may create a permanent loss of RCW habitat. Alternative D prohibits the permanent clearing of potential RCW habitat unless the loss of such habitat would not reduce the capability of the HMA to support its identified RCW population objective.

The Forest Service would evaluate all proposed clearings within HMAs and determine whether they would impact the RCW.

- Clearing would not be allowed if foraging habitat is limited or if the clearing causes a break between the foraging habitat and the cluster or recruitment stand.

- Prohibits clearings within 1/4 mile of groups in MIL 4 and MIL 5.

Alternative E (The Proposed Action)

SUMMARY - ALTERNATIVE E

Alternative E is based on the establishment of HMAs and rotation lengths ranging from 70 to 120 years. Rotations are based on research on the rate of heartwood development in longleaf and loblolly pine, and analysis of the age of existing cavity trees. It establishes four MILs and stresses the use of fire, including growing season burns, to control midstory vegetation.

The proposed action would set into motion an immediate and deferred set of actions, each containing various elements. These actions and elements are summarized in Chapter 1 (Purpose and Need) and presented in full detail in this chapter. The current conditions affecting the RCW and environmental effects are described in Chapter 3.

REVISED HANDBOOK

The Forest Service proposes to revise the Regional Wildlife Habitat Management Handbook, FSH 2609.23R (Handbook) and the Southern Regional Guide to incorporate the revised Handbook immediately after the Record of Decision (ROD). The revised Handbook would provide new regional direction for managing the red-cockaded woodpecker and its habitat. This direction would be implemented as National Forests with RCW populations individually amended or revise their Forest Plans. This would occur within one to three years after the ROD is signed.

Elements of the Proposed Handbook Revision

Alternative E would:

(1) Establish criteria to delineate RCW Habitat Management Areas (HMA) and determine population objectives to ensure demographic stability.

Alternative E is based on delineation of HMAs. The size of the HMAs would be based on the number and distribution of active and inactive clusters that existed in 1986. Each HMA would be classified as one of four Management Intensity Levels (MIL), which are based on the risk of extirpation (local extinction) faced by the RCW population in the HMA. The risk categories are determined based on a population's size and trend.

(2) Establish Regional Handbook direction for management of the red-cockaded woodpecker and its habitat.

- Emphasize the use of artificial cavities and the moving of RCW from area to area (translocation) to speed population expansion and eventual recovery of the species.

- Rotations would range from 70 to 120 years depending on the species of pine being managed. Alternative E would produce timber products and woodpecker habitat on a sustained-yield basis.

- Emphasize thinning to reduce southern pine beetle risk and enhance RCW habitat.

- Emphasize prescribed fire, including growing season burns, to control midstory vegetation in the pine and pine-hardwood forest types throughout HMAs, especially within clusters, replacement and recruitment stands.

- Assure adequate foraging habitat (6350 pine trees greater than 10 inches in diameter, 30 years old or older, and at least 8,490 square feet of pine basal area in pine stems larger than 5 inches DBH, within 1/2 mile of and connected to the clusters).

- Utilize a wide range of regeneration methods. The use of various silvicultural practices would be based on existing stand condition, site quality, and the need to balance current RCW habitat needs with regeneration of the forest to provide future habitat.

- Encourage restoration of longleaf and other desirable pine species in areas where they occurred historically and would provide better habitat for the RCW.

- Limit regeneration of the oldest 1/3 of pine and pine-hardwood acres until rotation age. This will ensure suitable potential cavity trees in the shortest time.

(3) Establish monitoring requirements to determine if the objectives of the new RCW management direction are being met.

- Link monitoring intensity to population size.

- Include implementation (quality control), effectiveness (systems control) and policy validation (mission control) monitoring.

IMMEDIATE ACTIONS

The immediate action is the same as described in Alternative C, pages 113-114.

DETAILED DESCRIPTION - ALTERNATIVE E

Habitat Management Area Delineation

The establishment of Habitat Management Areas (HMA) is an integral part of Alternative E (see page 44 for additional discussion). The Forest Service proposes to delineate HMAs for all active RCW populations dependent on National Forest lands (See Figure I-2). The three National Forests that had RCW in the past 20 years but none at present, would decide whether to develop HMAs and actively manage reintroduced support populations. This decision would be deferred until the Forests revise their Forest Plans.

The following is a summary of the HMA delineation process, which is explained in detail in Appendix A.

An individual HMA, tentative or permanent, should include sufficient acres of suitable habitat, foraging and nesting, to support at least 50 RCW groups. Recovery populations should have HMAs large enough to support 500 groups, if the land base will allow. Suitable RCW habitat includes pine and pine/hardwood forest types which have the potential to provide at least minimal RCW foraging habitat.

The delineation of HMAs is a three-step process:

(1) Delineate the historic RCW population.

Consider current and historic cluster distribution, including any clusters on adjacent private land within 18 miles of Forest Service System lands.

(2) Identify isolated subpopulations.

Consult recent surveys which describe the current condition of RCW distribution. Include all groups separated by five miles or less of currently suitable foraging habitat or three miles or less of currently unsuitable foraging habitat. Include all inactive clusters within five or three miles using the above suitability criteria.

(3) Delineate the HMA boundary.

Establish an HMA for all populations having one or more multiple bird groups. Extend the boundary to include subpopulations separated by 18 miles or less of potentially suitable habitat.

Subpopulations separated by three miles or more of permanently unsuitable habitat should be placed in a different HMA. Permanently unsuitable habitat, such as lakes, agricultural lands, riparian hardwood bottoms, is determined by its inherent suitability and traditional use. Private land (inholdings) should neither be automatically excluded or included as suitable RCW habitat.

Extend the HMA boundary at least 1/2 mile and preferably 3/4 mile from the geometric center of clusters to allow the population to expand in any direction, by assuring they would find suitable habitat around those clusters, if land ownership will allow.

Create corridors that are at least 2.5 miles wide, linking isolated subpopulations, if possible. These corridors would ideally approximate the width of the subpopulations' habitat area being linked. Broad corridors allow the RCW from the various subpopulations to colonize the corridor area, which improves effective dispersal and social interaction throughout the HMA.

Delineate the HMA boundary to coincide with administrative, topographic, stand, and compartment boundaries for ease of administration.

Extend the HMA boundary beyond Forest Service System lands to include suitable habitat on adjacent public lands only where a Memorandum of Understanding (MOU) has been signed for the purpose of joint RCW management. For example: The Oconee National Forest and adjacent Hitchiti Experimental Forest have a joint agreement with the USDI Fish and Wildlife Service, Piedmont National Wildlife Refuge.

Delineate the HMA boundary to exclude wildernesses, unless they have a wilderness management plan which allows prescribed burning and midstory control, essential management practices for maintenance of RCW habitat. All forests having RCW groups within a wilderness which is predominately longleaf pine are encouraged to develop such plans. If an individual Forest chooses not to manage its wilderness groups, that Forest must go through formal consultation with the U.S. Fish and Wildlife Service and obtain an incidental take statement.

Appendix D includes maps identifying tentative HMAs for all active RCW populations on National Forest land.

Delineation of Tentative HMA Boundaries

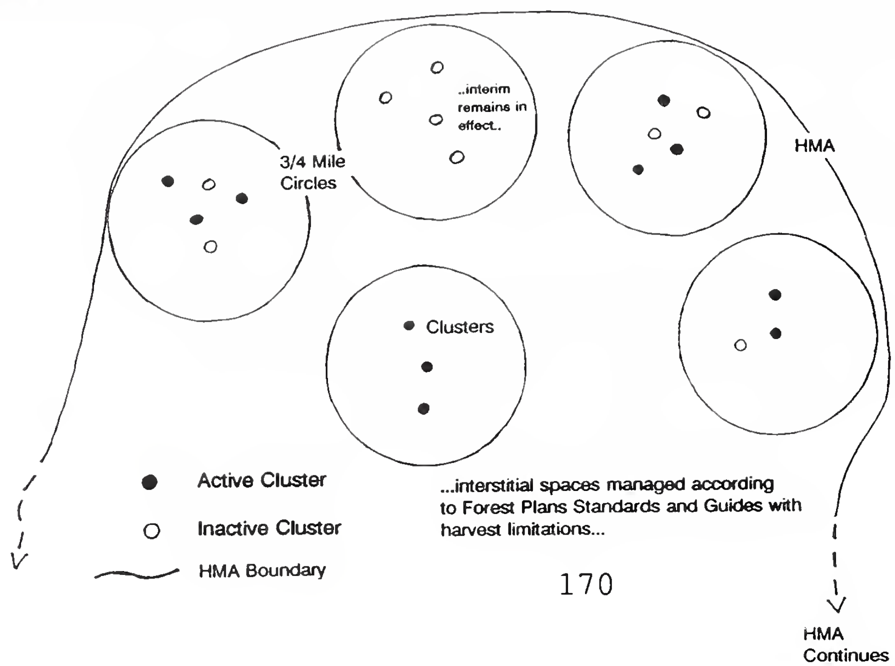
Full implementation of the new Regional RCW management direction may be delayed for two or more years due to the time necessary to complete forest plan revision/amendments. Interim S&Gs currently protect 3/4-mile radius circles around existing active and inactive clusters, but do not affect habitat outside the circles which would become part of the permanent HMA. The interdisciplinary team concluded immediate action was necessary to maintain future management options within the proposed HMA.

The interdisciplinary team feels it is essential to identify tentative HMAs immediately. This immediate action would allow thinnings, two-aged or uneven-aged management, which retain relatively high basal areas and canopy cover. The maintenance of this number of trees allows a wider range of silvicultural options in the future. Clearcutting would also be allowed to restore pine species more desirable to the RCW, primarily longleaf and shortleaf pine. If a Forest chooses to being restoration during the transition period between the signing of the ROD and their Forest Plan amendment or revision, the Forest must first identify sufficient recruitment stands and foraging habitat to meet their tentative population objective identified in Table 2-E1.These limitations apply to the areas within the tentative HMA but outside the 3/4-mile radius circles. Forest plan rotations, allowable sale quantities, etc., within these areas, will not be changed at this time. Any such changes will occur when the individual Forest Plans are revised/amended.

Tentative HMAs would be delineated using the process summarized on the preceding page and detailed in Appendix A. The boundaries would be finalized as a part of the Forest Plan amendment/revision to incorporate the new Regional RCW management direction. Figure 2-E1 illustrates how the tentative HMA strategy may appear when implemented on the ground.

Figure 2-E1
Tentative HMA Diagram

The proposed action would prescribe RCW management activities within tentative HMAs and outside of the 3/4-mile circles.



Setting Population Objectives

The Forest Service proposes to establish tentative population objectives in the EIS, and final objectives for each HMA in the Forest planning process. Permanent population objectives are determined after the permanent HMA has been delineated in Forest plans and are based on the area of suitable RCW habitat within each HMA. Appendix A of the EIS presents a detailed description of this process. The USDI-Fish and Wildlife Service determined a recovered population should have at least 250 groups annually fledging young (reproducing population). Present research indicates, on average, meeting this criterion would require 500 active clusters in the population. Therefore, a population objective of at least 500 active clusters must be established for recovery populations, if the land base allows. However, with population specific reproduction data, a population can be declared recovered if it has at least 250 groups annually fledging young for 5 consecutive years, and the population is not artificially maintained through translocation and artificial cavities. A population being declared recovered in no way affects the population objective. Support populations must be managed for at least 50 active clusters to ensure short-term viability. Most support populations will have population objectives well above this minimum. Table 2-E1 of the EIS lists the tentative population objective for each RCW population based on tentative HMA size and broad physiographic province density objectives.

The acreage needed to support a single RCW group varies by physiographic province. In general, habitat quality in the lower coastal plain is higher than that in the piedmont and mountains. Within physiographic provinces there is also variability in habitat capability based on ecological factors associated with individual landscapes. Soil properties, hydrology, and topographic features associated with a particular landscape can influence whether the resulting vegetation will be optimal, suitable, or marginal RCW habitat. For example, longleaf pine landscapes in the coastal plain will have a higher habitat capability than loblolly pine hardwood landscapes in the coastal plain. Because of this variability, each affected National Forest will refine the tentative population objectives established in the EIS for each of their HMAs, and establish final population objectives during the forest plan amendment or revision process. These refinements will be based on the following:

Acres of suitable and potentially suitable RCW habitat within permanent HMAs

RCW density objectives for individual landscapes within a given National Forest.

Desired future condition of these habitats based on land type associations

Generally, RCW population density objectives shall fall within the range of one group per 200 to 300 acres. However, it is recognized that some landscapes within a given HMA may require more acres per group. For example, wet loblolly pine-hardwood sites may require 400 acres and pond pine may require as much as 600 to 800 acres per group. No useable RCW habitat within an HMA should be excluded from RCW management, regardless of acres required to support a group.

The following are examples of how the above criteria could work.

Example 1. Support Population Objective

A tentative HMA in the coastal plain includes 50,000 acres of suitable RCW habitat. Based on a broad physiographic province density objective of 1 group per 200 acres, a tentative population objective of 250 groups would be identified. During the forest plan revision process a permanent HMA of 53,500 acres could be identified. Assume 80 percent of the HMA is longleaf pine and can support 1 group/200 acres; 15 percent of the HMA is loblolly pine and can support 1 group/250 acres; and 5 percent is loblolly pine hardwood and can support 1 group/275 acres. The HMA population objective would be 256 based on the above breakdown.

Example 2. Recovery Population Objective

A tentative HMA for a recovery population in the coastal plain includes 102,000 acres of suitable RCW habitat, and has a tentative population objective of 510 groups. During the forest plan revision process a permanent HMA of 99,000 acres is identified. Assume 90 percent of the HMA is longleaf pine and can support 1 group/200 acres; and 10 percent of the HMA is loblolly pine and can support 1 group/250 acres. The HMA population objective would be 486 based on the above breakdown. If any additional suitable RCW habitat exists on this forest, the permanent HMA must be increased in size to allow for a population objective of at least 500 groups.

The figures of 1 group/200 acres, 1 group/250 acres, and 1 group/275 acres for longleaf, loblolly, and loblolly pine hardwood, respectively, were used for example purposes only. These values should not be viewed as established standards. Each individual Forest will need to develop their own RCW density objectives based on local conditions.

MANAGEMENT INTENSITY LEVELS

Alternative E would establish four different management intensity levels based on the risk of extirpation faced by the RCW in each HMA or subpopulation within an HMA. See pages 44-46 for additional discussion.

Two sets of MIL classification criteria were developed; one set for populations with a land base large enough to support 500 groups, and another set for populations with inadequate acreage to support 500 groups. Tables 2-E2 and 2-E3 show the MIL breakdown for these two situations, respectively.

Table 2-E1

Tentative Habitat Management Areas (HMA) and Population Objectives.

Tentative HMAs are based on the distribution of existing active and inactive clusters (colony sites) rather than the current RCW population.

STATE	National Forests with HMAs (RECOVERY POP. UND)	Tentative HMA Area (Acres)	Population 1994	Tentative Pop. Objective	MIL
			(Active Clusters)		
ALABAMA	Bankhead	20,402	0	68	4
	Conecuh	61,817a	14	309	4
	Talladega-Oakmulgee Rd	98,584	120	394	3
	Talladega/Shoal Creek Rd	124,247a	4	413	4
		305,050	138	1,184	
ARKANSAS	Ouachita	68,521a	15	228	4
FLORIDA	Apalachicola-				
	Apalachicola RD	141,263	500	706*	1
	Wakulla RD	144,368	150	722*	3
	Ocala	48,400a	4	242	4
	Osceola	98,183a	45	462	4
		432,214	699	2,132	
GEORGIA	Oconee/Hitchiti **	52,966a	16	176**	4
KENTUCKY	Daniel Boone	48,487a	3	66	4
LOUISIANA	Kisatchie-				
	Catahoula RD	65,734a	27	328	4
	Evangeline RD	46,298a	52	231	4
	Kisatchie RD	59,267a	69	296	4
	Vernon RD	64,243	186	321	2
	Winn RD	56,297a	18	281	4
		291,839	352	1,457	
MISSISSIPPI	Bienville	125,160	92	500	3
	DeSoto-				
	Biloxi RD	38,293a	5	191	4
	Black Creek RD	35,467a	1	177	4
	Chickasawhay RD	100,494a	4	502	4
	Homochitto	67,755a	27	225	4
		367,169	129	1,595	
N.CAROLINA	Croatan	27,940	55	139	3
S.CAROLINA	Francis Marion	125,351	371	625*	2
TENNESSEE	Cherokee	6,150	1	n/a	4
TEXAS***	Angelina/Sabine	66,286a	42	329	4
	Davy Crockett	65,016a	38	325	4
	Sam Houston	105,194	149	525	3
		236,496	229	1,179	
SOUTHERN REGION		1,962,183	2,008	8,781	

* These populations can be declared recovered (MIL1) when they reach 500 active clusters and meet all other criteria needed for recovery.

** The Oconee NF is combined with Hitchiti Experimental Forest and Piedmont National Wildlife Refuge by Memorandum of Understanding (FSM 2609.23). The figures listed, however, show only the National Forest acreage and population objectives.

*** The National Forests in Texas are currently managed under a court order, which will remain in effect until the order is removed or a new order issued by the District Court.

Table 2-E2

MIL Criteria for RCW Populations with Land Base to Support 500 Groups

Potential breeding pairs or active clusters should be used when lacking accurate reproduction data to determine MIL for a population or subpopulation.

Management Intensity Level (MIL)	Reproducing Population	Potential Breeding Pairs	Active Clusters
<u>MIL 1 (Recovered/Low risk)</u> A population size of: with a stable or increasing population trend.	$\geq$ 250	$\geq$ 400	$\geq$ 500
<u>MIL 2 (Moderate risk)</u> A population size of: with a decreasing population trend: or	> 250	$\geq$ 400	$\geq$ 500
A population size of: with a stable or increasing population trend.	125-249	200-400	250-499
<u>MIL 3 (Severe risk)</u> A population size of: with a decreasing population trend; or	50-249	80-399	100-499
A population size of: with a stable or increasing population trend.	25-124	40-199	50-249
<u>MIL 4 (Extreme risk)</u> A population size of: regardless of trend; or	$\leq$ 25	$\leq$40	$\leq$ 50
A population size of: with a decreasing population trend.	25-49	40-79	50-99

The following MIL breakdown will apply to RCW populations occurring on Forest Service units which do not have adequate acres to support 500 groups. Two assumptions are made: The population objective in these HMAs will always be expressed as total active clusters, and the minimum population objective will be 50 active clusters.

Table 2-E3
MIL Criteria for RCW Populations Without Land Base to Support 500 Groups
The percentages represent a percentage of the HMA's population objective in total active clusters, potentially breeding pairs or reproducing population.

Management Intensity Level (MIL)	Reproducing Population	Potential Breeding Pairs	Active Clusters
MIL 1 (Recovered/Low risk) A population size of: with a stable or increasing population trend.	≥ 50%	≥ 80%	≥ 100%
MIL 2 (Moderate risk) A population size of: with a decreasing population trend: or	≥ 50%	≥80%	≥ 100%
A population size of: with a stable or increasing population trend but not less than 50 groups.	25%-49%	40%-80%	50%-99%
MIL 3 (Severe risk) A population size of: with a decreasing population trend but not less than 50 groups; or	10%-49%	16%-79%	25%-99%
A population size of: with a stable or increasing population trend but not less than 50 groups.	5%-25%	8%-40%	25%-49%
MIL 4 (Extreme risk) A population size of: regardless of trend; or	≤ 25	≤40	≤ 50
A population size of: regardless of trend but not less than 50 groups.	5%-10%	8%-16%	< 25%

An example of how to use this table: The population objective for an HMA is 321 active clusters determined by acres of potentially suitable habitat and density objective for specific physiographic province. The current population is 186 active clusters with an increasing trend the last 5 years. Reproducing population or group equivalents are unknown.

$$\frac{\textbf{Current Population}}{\textbf{Population Objective}} = \textbf{\% of Population Objective}$$

$$\frac{186}{321} = 58\%$$

Fifty-eight percent of the population objective is currently active clusters with an increasing population trend. In the table, this population falls in MIL 2 and would be managed accordingly.

Table 2-E4 briefly describes the different MILs and management practices associated with each.

Table 2-E4
Summary of Proposed RCW Management by MIL.
The RCW populations facing higher risk of extirpation are given progressively higher levels of habitat protection.

Risk Level Criteria	RECOVERED MIL 1 *	MODERATE RISK MIL 2 *	SEVERE RISK MIL 3 *	EXTREME RISK MIL 4 *
Population** Size & Trend	≥250 increasing or stable.	≥250 decreasing or 125-249 increasing	50-249 decreasing or 25-124 stable/ increasing	<25 all trends or 25-49 decreasing
Rotation Age (Years for various pines)***	120 Years-longleaf/ shortleaf 100 Years-loblolly/slash 70 Years-Virginia 80 Years-loblolly/ shortleaf in SPB areas	Same as MIL 1	Same as MIL 1	Same as MIL 1
Silvicultural Practice***	A wide range of Silvicultural options allowed, including even-aged and uneven-aged management	Similar to MIL 1, but emphasizes irregular shelterwood leaving 6 trees per acre	Similar to MIL 2, but leaves 25-30 BA of pine in irregular shelter-wood areas	Similar to MIL 3, but leaves 40 BA of pine in irregular shelterwood areas
Maximum Regeneration Patch Size***	40 acres	40 acres	25 acres	25 acres
Nesting Habitat Provision	Extended rotations, and replacement stands.	Extended rotations, replacement and recruitment stands, and an average of 6 potential cavity trees per acre would remain in regeneration areas.	Same as MIL 2, except that 25-30 BA of pine trees would remain in regeneration areas	Same as MIL 2, except that 40 BA of pine trees would remain in regeneration areas
Fragmentation Prevention***	Extended rotations, regeneration method and patch size limits. **	Same as described for MIL 1 ***	Same as described for MIL 1, plus no even-aged mgmt. within 1/4 mile of active clusters. ***	Same as MIL 3. ***
Prescribed Burning	Where possible, prescribed burning will be used intensively in all MILs to aid in control of midstory vegetation in RCW habitat. Other control methods, manual, mechanical or chemical may be necessary.			

* When an RCW population is reassigned to a new MIL, the management practices for the newly assigned MIL would be implemented from that time forward.

** All population sizes refer to number of actively breeding RCW groups. Actual number of active groups may be greater.

*** Extended rotations, regeneration method and stand size limits listed for each MIL all contribute in reducing RCW habitat fragmentation.

Establishment of Subhabitat Management Areas

Several RCW populations have very few groups, but would require delineation of relatively large HMAs. Most of these are identified as recovery populations in the RCW Recovery Plan and therefore require HMAs large enough (100,000 to 150,000 acres of suitable habitat) to support 500 or more active clusters, despite the fact they contain few RCW at present. Also, some support populations, due to the presence of two or more widely separated subpopulations, may have large HMAs with relatively few RCW.

It would likely take decades for an RCW population to grow to fill the available habitat within these HMAs. The Forest Service proposes a sub-HMA strategy for the large area/small population HMAs. The sub-HMA strategy will only be applied to populations in MIL 4.

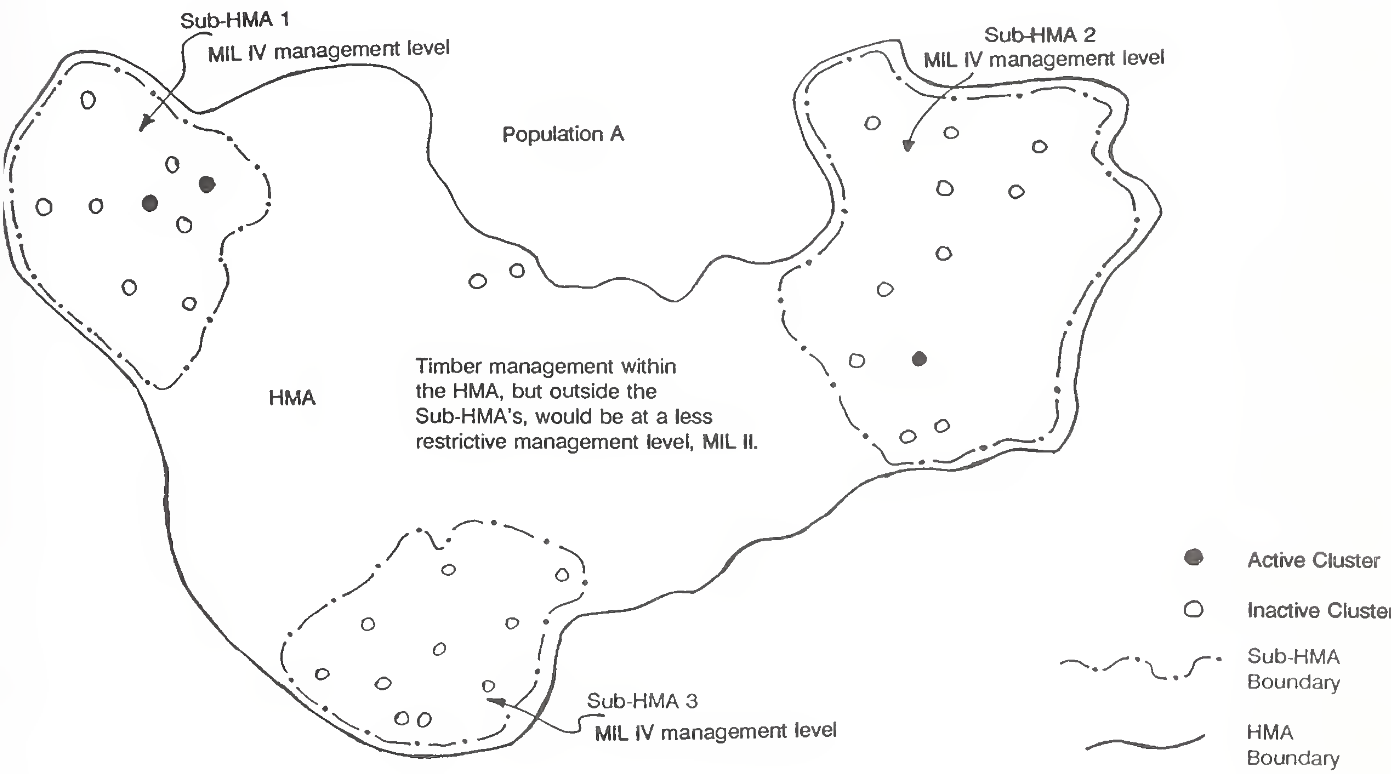
Upon approval of the Regional Forester, a sub-HMA(s) may be delineated within an HMA. All active RCW clusters must be included in the sub-HMA(s). Each sub-HMA will be approximately 10,000-15,000 acres of suitable habitat (large enough to support 50 RCW groups and sustain short-term viability). Management within the sub-HMA(s) would be according to standards and guidelines established for MIL 4. The immediate and short-term needs of existing RCW groups would be met within the sub-HMA.

The areas within the HMA, but outside the sub-HMA, would be managed according to standards and guidelines established for populations in MIL 2. Regeneration of forest stands, using two-aged or uneven-aged silviculture, could continue. Good habitat for future RCW population expansion would be created or maintained over time by this regeneration. Although this strategy would allow the continued harvest of some forest products, timber production is secondary to meeting RCW habitat objectives.

The sub-HMA strategy is desirable because it allows the forest manager to move toward establishing a balanced age/size class distribution which will be beneficial to the RCW in the long-term. A balanced age/size class distribution helps ensure a sustained flow of RCW habitat through time and may make the forest less vulnerable to damage by hurricanes (Hooper and McAdie 1995). The sub-HMA strategy also helps reduce economic impacts, especially in the most heavily impacted rural areas. It is felt this economic concession can be made with no adverse effects to the RCW.

Management based on MIL 2 standards and guidelines would ensure suitable habitat for RCW population expansion when the population of the sub-HMA begins to spread into the remainder of the HMA. When considering regeneration methods within these areas, restoration of longleaf or other desirable pine species would receive priority due to its long-term positive benefit to RCW. Figure 2-E2 illustrates how this strategy may look when implemented.

Figure 2-E2
How a HMA Managed With the Sub-HMA Strategy May Appear.
Different levels of management will be applied in different portions of the HMA.
Each sub-HMA must be large enough to support at least 50 RCW groups.



The following would be the direction to determine if the establishment of sub-HMA(s) is appropriate:

Delineate the population, isolated subpopulations, and the HMA boundary using the direction in Appendix A. Determine the MIL classification using current RCW population data. HMAs classified as MIL 4 will be considered for the sub-HMA strategy.

Determine the area of potentially suitable habitat (appropriate pine and pine-hardwood forest types regardless of age) associated with each subpopulation (sub-HMA). It must be large enough to support 50 groups (10,000-15,000 acres depending on physiographic province). If not, expand the boundary of the subpopulation (sub-HMA) to include adequate acreage for 50 groups. The objective is subpopulations large enough to sustain short-term viability.

Compare the total acres of potentially suitable habitat in all sub-HMA(s) to the acreage for the HMA as a whole. If the potential sub-HMA aggregate total is 60 percent or less of the total suitable habitat in the HMA, the Forest may request authority to implement the sub-HMA strategy from the Regional Forester.

Submit a request, including all supporting documentation, to the Regional Forester to implement the sub-HMA strategy. Supporting documentation must include a map showing permanent HMA, proposed sub-HMA, location of all active RCW clusters, location of all recruitment stands, and all calculations used to show the sub-HMA is 60 percent or less of the total suitable habitat in the HMA.

The following forest management practices (MIL 2 standards and guidelines) may be applied to the area within the HMA but outside the sub-HMA(s).

- Uneven-aged silviculture (single-tree and group selection) may be used in some situations wherever tree species and site conditions permit and where foraging habitat is not limited.

- Even-aged silviculture (shelterwood and seed-tree with reserve trees) may also be used if foraging habitat is not limited. A minimum of six trees per acre must be reserved in each regenerated area. An exception to this requirement involves the restoration of longleaf or other desirable pine species. In regeneration areas involving restoration only trees of the species being restored would be retained. These trees will not be scheduled for harvest for at least one full rotation. The priorities for selecting these trees are:

  (1) relict trees
  (2) other potential cavity trees
  (3) other trees greater than 10 inches in diameter that meet seed tree requirements

This priority would ensure the availability of potential cavity trees in the future, when RCW have expanded into these areas.

It is important to ensure the area occupied by stands in the 0-10 age class do not exceed a level which could fragment RCW habitat. This is especially important during the first 10-year entry period following implementation of this strategy. In those portions of the HMA (but outside the sub-HMA) where shelterwood and seed-tree methods are used, habitat fragmentation can be avoided by using the following guidelines:

(1) The appropriate regeneration level would be established based on prescribed rotation age for the pine species being managed. For example, if managing loblolly pine on a loblolly site the old A/R X T for loblolly would be used when calculating the allowable regeneration acres. However, in restoration situations, the old and new A/R X T for the pine species being restored would be used in the calculation. Even-aged silvicultural systems are regulated for sustainable regeneration cutting over time by area control, which allows a certain amount of land area to be regenerated in a given time period. The process to calculate the allowable regeneration area (A/R x T) has been previously described on page 60.

(2) Based on analysis of existing viable RCW populations the RCW team determined the allowable regeneration the first decade cannot exceed the total of the old rotation (A/R X T) plus the new rotation (A/R X T) less the existing percentage in the 0-10 age class, by more than 20 percent.

In those portions of an HMA (but outside a sub-HMA) which are managed with even-aged or two-aged methods, use the following formula to determine allowable regeneration percentage, by forest type or management type, during the first 10-year period:

$$ARP = 1.2T/Old\ R + T/New\ R - P$$

Where:	ARP	=	Allowable Regeneration Percentage
	T	=	the time of each entry cycle, in years
	Old R	=	the old rotation length of forest/management type, in years
	New R	=	the new rotation length of forest/management type, in years
	P	=	Percent of sub-HMA currently in the 0-10 year age class
Example:	T	=	10 year cycle
	Old R	=	80 year rotation
	New R	=	120 year rotation
	P	=	17% of longleaf pine is in 0-10 year age class = .170
	ARP	=	1.2 (10)/80) + 10/120 - .170
	ARP	=	.150 + .083 - .170
	ARP	=	.063

At present, 6.3% of the longleaf pine in the HMA (but outside the sub-HMA) may be regenerated.

The allowable regeneration acres of 6.3 percent is the percentage of the longleaf pine type which could be regenerated the first 10-year period in this HMA. The allowable acres cannot exceed A/R X T for the new rotation. In subsequent 10-year periods, allowable acres will be based on the prescribed rotation.

Portions of the HMA managed with uneven-aged silvicultural systems are not included in the above calculations to determine allowable regeneration acres for areas managed with a two-aged and even-aged system.

PROTECTION OF CLUSTERS, REPLACEMENT, AND RECRUITMENT STANDS

The Forest Service proposes to incorporate the following standards and guidelines into the Handbook to ensure RCW clusters, replacement and recruitment stands (described on page 46) are not adversely affected by other forest management activities.

Cutting

All alternatives would prohibit timber harvest, cutting, or killing of trees within clusters, recruitment stands, and replacement stands except where those actions would protect or improve RCW habitat. Snags or other dead trees will not be removed unless they posed a threat to public safety.

The alternatives would prohibit cutting of cavity trees in active and inactive clusters unless they posed a threat to public safety, or to protect the cluster, recruitment stand, and replacement stand from insect attack. The Fish and Wildlife Service shall be consulted and issue a concurrence before any cavity tree would be cut.

Motorized, Heavy Equipment, and Concentrated Human Use Areas

Alternative E requires habitat improvement projects involving motorized or heavy equipment to include sufficient project administration and/or contract language to protect the cluster, recruitment stand, and replacement stand, especially cavity trees and potential cavity trees.

These alternatives would prohibit concentrated equipment use, such as log decks, pine straw bailing operations, off-road vehicle trails, trail heads, and camp sites within clusters, recruitment stands, and replacement stands.

The Forest Service will relocate or modify existing uses and activities if they are found to adversely affect the RCW.

The Forest Service will locate all future concentrated human use areas, such as off-road vehicle trails, camp sites, and trail heads outside of cluster, recruitment stand, and replacement stand boundaries.

Cavity Tree Protection During Prescribed Burning Operations

All alternatives encourage prescribed burning to control midstory vegetation for the benefit of the RCW, but require the burning prescription and cycles to minimize risk to cavity trees.

Cavity trees may be protected by raking away or back burning adjacent fuels. Plow lines will be placed beyond 200 feet of cavity trees to prevent root damage unless needed to protect the cavity trees during an emergency or if site specific circumstances such as location of property boundary etc., dictate the need to locate them closer.

Nesting Season Disturbance

The Forest Service would require scheduling all potentially disturbing activities within the cluster before or after the nesting season. The general nesting season dates will be used unless the specific group's nesting season is documented and monitored to account for individual variation.

The Forest Service would also restrict its habitat improvement activities within clusters during the nesting season, unless such activity during the nesting season is necessary for the continued survival of the RCW group. An exception to this limitation is prescribed burning, which may be allowed.

Construction Of Rights-of-Way

Alternative E would prohibit all construction of linear rights-of-way, such as roads, powerlines, or pipelines within a cluster, recruitment or replacement stand.

Existing Rights-of-Way Reconstruction and Maintenance

Alternative E would allow reconstruction or maintenance of existing roads through clusters, recruitment stands, and replacement stands if detailed study shows such activities will not adversely affect RCW and the activities are scheduled before or after the nesting season.

Road and rights-of-way reconstruction/maintenance through clusters will be closely monitored to ensure protection of cavity trees and potential cavity trees. Light maintenance of high standard open roads, such as road grading or mowing of the rights-of-way, which are no more disturbing than the passage of normal traffic, will be allowed during the nesting season.

Southern Pine Beetle Suppression

The Forest Service will attempt to minimize the impact of southern pine beetle to cavity trees and foraging habitat. When RCW clusters, recruitment stands, and replacement stands are threatened by southern pine beetles, a biologist and entomologist would recommend a course of action before taking control measures.

The Southern Pine Beetle Record of Decision (USDA FS, 1987, p. 33), sets standards and guidelines for protecting both cavity trees and the RCW during control operations as follows:

- Prohibits cutting of trees already vacated by beetles unless they pose a threat to public safety.
- Allows cutting of inactive or relict cavity trees, if infested, within a designated treatment buffer zone only to protect the rest of the cluster.
- Allows cutting of uninfested trees within 200 feet of a cavity tree only to protect cavity trees.
- Prohibits cut and remove operations during nesting season.
- Allows only minimal disturbance, such as cutting or chemical treatment, if necessary to protect the cavity trees during nesting season.
- Prohibits the use of the pile and burn control technique within clusters.

Alternative E differs from the Southern Pine Beetle Record of Decision and other alternatives in that wilderness RCW groups are considered non-essential and southern pine beetle control would not be initiated to protect wilderness RCW groups or their foraging habitat. However, southern pine beetle control could be initiated within wilderness to protect RCW groups or their foraging habitat if they are immediately adjacent (within 1/4 mile) to the wilderness boundary. Foraging habitat that occurs in wilderness will not be protected.

MANAGEMENT OF CLUSTERS, REPLACEMENT, AND RECRUITMENT STANDS

The Forest Service proposes to actively manage the RCW clusters, recruitment, and replacement stands to ensure continued viability and population growth.

Marking Cavity Trees and Cluster Boundaries (Monumentation)

All alternatives require the marking of cavity trees to reduce the risk of accidental damage. The Forest Service needs to know where the cavity trees are located on-the-ground to consistently apply the protective standards and guidelines and monitor the cluster.

The Forest Service will mark all active and inactive cavity trees and check and update whenever a cluster is visited. The boundaries of clusters or recruitment stands with cavities (active or inactive) must be marked when a project that would alter the habitat, such as tree harvesting or road construction, is planned within 1/4 mile of a cluster (active and inactive). The marking of cluster boundaries may be temporary (signs or flagging tape) or permanent (paint).

Cluster Status - Data Base Management

All alternatives would recognize and require tracking of six cluster status categories (active, inactive, abandoned, historic, destroyed, and invalid) which are defined in the glossary.

The Forest Service will maintain and update a data base which includes status category of all RCW clusters within the HMAs. The data base will link monitoring and survey data and show areas where replacement and recruitment stands are necessary.

Cavity trees will be preserved in all cluster categories except invalid. Special cluster management is not required for abandoned, historic, or destroyed clusters unless identified as recruitment or replacement stands.

Changes in cluster status should be tracked and the database updated annually. Active clusters may be declared inactive if no RCWs are living in them. Table 2-E5 shows when an inactive cluster may be declared abandoned if not identified as a recruitment or replacement stand.

Table 2-E5

Abandoned Cluster Timetable

Inactive clusters in MIL 2 and MIL 3 with declining populations and all MIL 4 populations cannot be declared abandoned.

MIL	Population Trend	Minimum Time (Years)*
1	Stable or Increasing	5
2	Stable or Increasing	10
2	Decreasing	n/a
3	Stable or Increasing	10
3	Decreasing	n/a
4	Any	n/a

n/a: Cannot be abandoned

* Site specific conditions may allow abandonment earlier than shown. Such situations will be evaluated on an individual basis and require informal consultation with and concurrence by the Fish and Wildlife Service.

Recruitment Stands

Alternative E would establish recruitment stands.

The Forest Service will establish recruitment stands in each HMA where the population objective exceeds the current RCW population. Recruitment stands are optional in MIL 1. The number of recruitment stands should equal the HMA population objective minus the number of groups in that HMA.

The selection criteria include:

- Nesting suitability considering stand age, forest type, and availability of relicts.

  The oldest available stands or younger stands with sufficient relicts should be selected. Inactive clusters may also be designated as recruitment stands. Midstory control should be completed and recruitment stands may be improved by installing artificial cavities.

- Distance to a cluster.

  Recruitment stands should lie within 1/4 mile to 3/4 mile from a cluster or other recruitment stands to ensure good spatial distribution and increase probability of colonization.

- Must have adequate suitable foraging habitat connected to the cluster or recruitment stand.

- Clusters inside wilderness.

  Recruitment stands for RCW groups living in wilderness, not included in a HMA, should be located outside the wilderness boundary. This action would encourage the RCW population to extend itself away from the wilderness into the HMA where the clusters can be managed for its benefit. Wildernesses are excluded from HMAs unless the specific wilderness management plan can accommodate RCW management.

- Clusters on private land.

  Recruitment stands should be established for RCW groups living on adjacent private lands within 3/4 mile of Forest Service System lands. These stands should be located on National Forest lands as close to the cluster as possible. This action would encourage the RCW to move to Forest Service lands where cluster management can take place.

The two preceeding situations, clusters in wilderness on private land, are unique in that recruitment stands are normally not established for existing groups. However, in these cases the objective is to entice the RCW to move to an area where they can be better protected and managed.

Replacement Stands

Alternative E would establish replacement stands, which are crucial for sustaining populations, for all active clusters. These stands will replace existing clusters as their cavity trees die.

The selection criteria include:

- Nesting suitability considering stand age, forest type, availability of relicts.

  Inactive clusters may be designated as replacement stands.

- Distance to a cluster.

  A replacement stand should be adjacent to the cluster if possible, and no more than 1/2 mile from it.

- Replacement stands should ideally be 20 to 30 years younger than the cavity trees in the cluster.

- Clusters within wilderness.

  Replacement stands for RCW groups living in wildernesses, not included in a HMA, should be established as close to the cluster as possible, but located outside the wilderness boundary.

- Clusters on private land.

  Replacement stands would not be established adjacent to clusters on private lands until the group has moved onto National Forest land.

Midstory Vegetation Control

Midstory reduction/control is a critical element of RCW recovery (see page 47 for additional discussion).

Alternative E requires midstory control over the entire stand, at least 10 acres for each cluster. The treatment should eliminate all hardwood midstory trees within a 50-foot radius of all active and inactive cavity trees. An average of three selected midstory hardwoods per acre can remain throughout the remainder of the cluster. Desirable species are dogwood, redbud, or other shrubby fruiting or flowering species.

Pine midstory should be controlled before the trees block access to cavity trees, potential cavity trees and line-of-sight between them. However, the pine midstory (usually saplings and pole size trees) needed to replace the stand must be reserved.

No more than 10 within canopy hardwood trees per acre, dominant and codominants, may be reserved within the treatment area.

In areas where cluster, recruitment stand or replacement stand boundaries may include natural hardwood areas, such as stream bottoms, no treatment should occur to eliminate hardwoods or to control midstory within the natural hardwood area unless absolutely necessary to maintain the viability of the RCW group.

Outside clusters, recruitment stands, and replacement stands but within the HMA, the reduction of hardwood midstory is encouraged in the pine and pine-hardwood forest types. The objective is improvement of foraging habitat. Prescribed burning will be the primary tool to accomplish this objective.

Prescribed burning is generally the best way to control midstory vegetation, especially small hardwoods. The RCW prefers an open park-like forest which can be maintained by underburning every two to five years after pine trees reach a fire-resistant stage.

Emphasis should be placed on growing season burning, especially in those habitats which were naturally maintained by growing season fires: e.g., longleaf pine-wiregrass, longleaf pine-bluestem and shortleaf pine-bluestem. This would approximate natural conditions historically prevalent in these habitats. After midstory is controlled, burning during other seasons can be used infrequently.

The Forest Service will prioritize and schedule maintenance burns for those clusters, recruitment, and replacement stands having already received initial treatment to eliminate midstory. Maintenance would receive priority to ensure previous investments in initial midstory control are not lost.

Artificial Cavities

Artificial cavities and their role in the recovery of the RCW have been previously described on pages 47-51. Alternative E would require artificial cavities in MIL 2 through MIL 4 and recommend additional start holes for higher risk populations as shown in Table 2-E6.

The Forest Service will use the procedures and methods specified by Taylor and Hooper (1991) and Allen (1991) to construct or install artificial cavities in suitable trees. Only individuals experienced in the respective techniques should install artificial cavities. Midstory vegetation must be controlled in conjunction with installation of artificial cavities. The Forest Service would prioritize and schedule installations to provide cavities where they are needed most.

The following priorities will be used:

(1) Active clusters with a single cavity.

(2) When needed to support augmentation of single bird groups.

(3) Active clusters with fewer than four usable cavities.

(4) Recruitment stands, which may be inactive clusters, with fewer than four usable cavities within 1.5 miles of an active cluster.

(5) Recruitment stands, which may be inactive clusters, with fewer than four usable cavities within three miles of an active cluster.

(6) Inactive clusters or recruitment stands more than three miles from an active cluster.

As the priorities imply, artificial cavities should first be installed in or very near active clusters and then progressively move to stands further away.

Table 2-E6
Artificial Cavity Requirements
Drilled start-holes are recommended in MIL 3 and MIL 4 in addition to completed drilled cavities or cavity inserts.

MIL	Artificial Cavities	Specified Type
1	Optional	As appropriate
2	Required	As appropriate
3	Required	Complete cavities plus >2 start holes
4	Required	Complete cavities plus >2 start holes

Reducing Cavity Competition

Cavity restructures are metal plates with an oblong hole large enough for the RCW (generally 1-3/4" by 2-3/4" as shown in **Figure 2-3**). Cavity restrictors are placed around cavity entrances to prevent other birds (especially pileated and red-bellied woodpeckers) and mammals from enlarging them and displacing the RCW (Carter et al. 1989). Limited cavity availability in some areas, has adversely affected the RCW. Cavity competition can be minimized by the following:

- Ensure that each group has at least four functional cavities through use of restrictors and/or artificial cavities.

- Within 1/2 mile of active RCW clusters and inactive clusters or recruitment stands that have been made suitable for augmentation, retain uninfested/SPB vacated single dead trees. Within 1/4 mile of inactive RCW clusters which are not suitable for augmentation, retain uninfested/SPB vacated single dead trees. In SPB spots one acre or larger in size, retain a minimum of six vacated sawtimber trees per acre, if available, two of which should be the larger vacated trees. In SPB spots less than one acre, retain a minimum of two larger vacated sawtimber trees, if available. Preliminary research suggest presence of snags with cavities in and near clusters may reduce competition for RCW cavities (Harlow and Lennartz 1983, Kappes 1994. This does not preclude salvage of dead trees from large areas resulting from insect outbreaks, hurricanes, tornadoes or other catastrophic occurrences.

- Maintain adequate levels of midstory control. This creates an unsuitable habitat condition for some cavity competitors.

- Install squirrel and snake excluder devices (non-lethal) as needed (Montague and Neal 1995, Withgott et al. 1995).

Cavity restrictors should be placed on enlarged RCW cavities and on unenlarged cavities where experience shows cavity enlargement is likely. The highest priority is active clusters which have a single cavity tree followed by single bird groups, then those clusters with two to four suitable cavities, and five to eight cavities.

All artificial cavities should be fitted with restrictors when installed.

Restrictors should not be used on cavities which have been enlarged internally to the point of being unusable by RCW.

The Forest Service will monitor cavity restrictors to ensure proper installation and acceptance by the RCW.

Cavity restrictors and their role in the recovery of the RCW have been previously described on pages 51-52. Alternative E requires the use of restrictors, where needed, in MIL 2 through MIL 4, and in MIL 1 if warranted by the particular site-specific conditions.

Translocation

Translocation of RCW and its role in the recovery of the RCW have been previously described on pages 52-53.

The Forest Service will develop priorities and schedule translocation of RCW to best achieve the desired objectives. Priorities are usually based on the spatial distribution of existing groups and the probability of natural dispersal of juvenile RCWs being successful. Any single-bird group could be a candidate for augmentation, one type of translocation in which a juvenile RCW of the appropriate sex is moved to a single bird group to create a potential breeding pair.

However, if a single-bird group is more than a mile from another group containing a breeding pair it would be a higher priority than a single-bird group which had four or more breeding groups within the same mile distance. This is because the RCW in the second example has a much higher probability of receiving a new mate through natural dispersals than does the one which is far removed from a breeding group.

The priorities for reintroduction of RCW groups varies by management objective. If the technique is being used to expand an existing population, the priorities would be similar to those above for augmentation. It is also suggested this method not be used until all single bird groups in the population have been augmented.

If the management objective is the reestablishment of RCW into currently unoccupied habitat, those areas known to have held RCW since 1970 should be first priority.

The translocation of RCW within populations/subpopulations is encouraged. The short distances birds must be moved and the frequent similarity of the habitat may increase the probability of successful pairings. If translocations between populations are necessary, it is desirable to move birds between areas that are of similar latitude, elevation, and forest type.

The planned translocation of RCW will be required to maintain the genetic viability of populations with a reproducing population of less than 250. The effectiveness of such translocations will depend on the number of RCW moved to a specific population and the genetic makeup of these birds in relation to the receiving population. Such genetic exchanges can be through normal subadult augmentation.

The objective is to identify all single bird groups and move an appropriate sex juvenile bird to it, in an effort to create a breeding pair. Priority should be given to single bird groups in RCW populations with fewer than 50 active clusters.

HABITAT MANAGEMENT WITHIN HMAs

The area within HMAs and outside of cluster, recruitment stand, and replacement stand boundaries would be managed for a full range of multiple uses, but would emphasize the sustained production of RCW foraging and future nesting habitat.

Prescribed Burning

The Forest Service should annually prescribe-burn approximately 490,000 acres within HMAs throughout the Southern Region. The Forest Service would schedule as many prescribed burns as possible during the growing season, where appropriate. However, the acreage to be burned to accomplish habitat goals may require burning whenever conditions permit year-round. The Forest Service will use natural firebreaks (streams, swamps, lakes, etc.) wherever possible to reduce the impact from constructing firelines. See pages 53-54 for additional discussion.

Pine Restoration

As important as restoring desirable pine species is to the long-term survival and recovery of the RCW, it is also important to schedule pine restoration to minimize any potential adverse effects of creating age class imbalances in the pine type age class distribution. When developing a restoration program, a Forest plan must first identify the total number of acres within an HMA needing to be restored. Based on this information, an individual Forest Plan has the flexibility to determine how many acres to restore per entry to meet its objectives. The Forest Service would base the rate of pine restoration on rotation and age class distribution for either forest type or management type.

- The forest type describes the species of trees currently growing on the site. For example, the existing longleaf pine age class distribution would determine the number of acres restored to longleaf pine each decade.

- The management type describes which species would have historically occupied the site. For example, the age class distribution of existing longleaf pine plus whatever loblolly, slash pine, etc., are growing on longleaf sites would be combined to calculate the number of acres restored to longleaf each decade.

Management types do not reflect the actual acres of the preferred species, in this longleaf pine example. The inclusion of the acres occupied by the off site species inflates the total acres, which in turn increases the acres which could be cut each decade. For example: An HMA contains 10,000 acres of existing longleaf pine. Off site slash pine is growing on another 10,000 acres. If the acres to be regenerated is based on forest type for the desired species, 830 acres could be restored to longleaf each 10 years. If regeneration acres is based on management type (the longleaf acres plus off site acres), 1660 acres could theoretically be harvested each 10 years.

If the allowed regeneration acres based on management type were cut from the existing longleaf stands they would be rapidly harvested. Therefore, if management type is used to determine the rate of pine restoration, Alternative E prohibits regeneration of existing stands of the species being restored until these stands reach rotation age. To continue with the above example, none of the existing longleaf stands could be regenerated until they reach rotation age (120 years). Alternative E makes an exception to this regeneration restriction where the restored pine type (longleaf) is managed as an uneven-aged stand.

In order to expedite the restoration of desirable pine species, the number of acres which can be regenerated the first entry period should be the restoration target for all subsequent entry periods. Again using the above example for management type, 1660 acres of restoration would be the objective each 10 year entry period until all restoration is completed.

When restoration is complete, all restored acres are calculated in the restored pine type age class distribution. Alternative E would restrict the number of restoration acres in the 0 to 10 and 0 to 30 year age classes in the same manner as any other regeneration acres. Alternative E would make three exceptions to the age class requirements.

(1) HMAs with Sparse or Scattered RCW Populations.

To expedite restoration beyond 1.5 miles from active clusters, foraging habitat for recruitment stands beyond this 1.5 mile buffer may be reduced as described on page 194 of the EIS. To ensure landscape conditions exist that will not adversely affect the RCW, the following standards must be followed.

During the first 10 to 20 years, accelerated restoration efforts should be focused on the area outside the 1.5 mile buffer around active clusters.

The restoration objectives must ensure corridors linking buffer areas are not fragmented by avoiding the creation of permanent or temporary barriers that inhibit or prevent RCW movement between areas of activity. A barrier is considered to be any non-forest area or any forested area not providing foraging habitat or a combination of the two greater than 330 feet wide. Any openings created cannot completely isolate or sever a cluster, recruitment stand, or replacement stand from its foraging habitat, sever connecting corridors, etc.

Recruitment stands must not be isolated from continuous pine or pine-hardwood overstory canopy.

To expedite restoration, the 0 - 10 year age class restrictions can be exceeded during the first 20 years of implementation, but in no case should the 0 - 10 age class exceed 15 percent. The 0 - 30 year age class restrictions can be exceeded during the first 20 years of implementation, but in no case should the 0 - 30 age class exceed 40 percent. These age class calculations should be based on the management type, which in most cases will be longleaf or shortleaf pine.

During the period of restoration, existing stands of the desirable pine type will not be regenerated until they reach rotation age, but thinnings may occur within these stands. If regeneration of the desired pine type is necessary to help achieve balanced age classes, regeneration may occur, but it must not occur in the oldest 1/3 of the desired pine type age class distribution.

Regeneration patch size for restoration will not exceed 40 acres.

All trees of the desirable species will be retained during restoration, unless their density is greater than 70 square feet of basal area, in which case the desired trees should be thinned to improve RCW habitat conditions.

(2) Off site pines occupying the site.

Restoration could exceed the 0 to 10 and 0 to 30 age class distribution guidelines when the soils or other site factors are truly incompatible with the pine species currently growing there. The existing pine trees may be subject to very slow growth, stagnation (growth stops completely), or may grow quite well for a period of time, perhaps as long as 50 years, then suddenly die.

Normally the formula on page 60 would be used to calculate the allowed regeneration acreage in this situation. However, under certain circumstances an accelerated rate of restoration may be desirable. An example is off site species which die at a rapid rate, reducing available foraging habitat for RCW groups. This is a "Catch 22" situation. To regenerate the stand and restore the proper species will essentially eliminate its foraging suitability. At the same time, natural mortality is rapidly reducing the available foraging. Such cases require a thorough site-specific analysis to evaluate impacts and trade-offs, and to determine what mitigation measures are available.

(3) Off site pines less than 10 inches in diameter.

A third exception to the above limitations on the acres which can be regenerated in any 10-year period is truly off site species which are not large enough to be foraging habitat (less than 10 inches diameter). An example is stagnated slash pine which may be 25-30 years old but only 4-5 inches in diameter. In such situations pine restoration is encouraged and can proceed at an accelerated rate. However, even in these situations some thought should be given to spreading out the regeneration to avoid undesirable age class bulges in the future.

During all restoration efforts all existing trees of the species being restored should be retained. This will expedite development of potential cavity trees.

Any pine restoration which exceeds the acres normally allowed in the 0-10 and 0-30 age classes must be approved in writing by the Regional Office. See page 54 for additional discussion.

Foraging Habitat Management

Alternative E would provide foraging habitat as described on pages 54-56.

The Forest Service would evaluate foraging habitat within 1/2 mile of clusters and recruitment stands when pine tree removal is planned to ensure adequate foraging habitat is available after any harvest. Procedures described in the Fish and Wildlife Service Blue Book (USDI Fish and Wildlife Service 1989) will be followed.

Hooper and Lennartz (1995) suggest there may be some circumstances when a RCW population would benefit in the long-term by having its foraging habitat reduced below 6350 stems. Some examples of such circumstances are: (1) in recovery HMAs where the risk from hurricanes makes it especially desirable to have a balance of age classes as soon as possible (Hooper and McAdie 1995); (2) in the thinning of pine stands to reduce the risk of southern pine beetle infestation (Thatcher et al. 1986); (3) in the removal of trees infested with southern pine beetles in order to avoid a major epidemic (Billings and Varner 1986); and (4) in restoration of longleaf or other desirable pine species.

When reducing foraging habitat below established levels for restoration of more desirable pine types, the following standards apply.

All active clusters and recruitment stands within 1.5 miles of an active cluster, must have a minimum of 6,350 pine stems $\geq$ 10" DBH and at least 30 years old, and a minimum of 8,490 square feet of pine basal area, contiguous and continuous with the cluster or recruitment stand and within 1/2 mile of the center of the cluster or recruitment stand. If this habitat cannot be provided within 1/2 mile, it must be provided as close to the 1/2 mile zone as possible (USDI Fish and Wildlife Service 1989). These are the USFWS "Blue Book" requirements.

For recruitment stands identified beyond 1.5 miles of an active cluster, foraging habitat can be reduced to 50 percent of the USFWS "Blue Book" requirements. Therefore, a minimum of 3,175 pine stems $\geq$ 10" DBH and at least 30 years old, and a minimum of 4,250 square feet of pine basal area would be required. This habitat must be contiguous and continuous with the recruitment stand.

If an active cluster is found or a recruitment stand is activated beyond the 1.5 mile buffer, the USFWS "Blue Book" foraging requirements must be provided for this cluster as well as all recruitment stands within 1.5 miles of the new cluster. In this manner, as a population grows, all active clusters and recruitment stands within 1.5 miles of an active cluster will have adequate foraging habitat. This buffering must remain in effect until all recruitment stands are within 1.5 miles of an active cluster. At that time, all clusters and recruitment stands will have adequate foraging habitat.

The Forest Service's goal is to provide the highest quality foraging habitat as close as possible to RCW clusters, rather than large areas of poor habitat. Thinning within RCW foraging habitat should maintain at least 70 square feet of pine basal area. Where foraging habitat is limited, the Forest Service will make thinning stands less than 10 inches diameter within 1/2 mile of the cluster (closer to the cluster the better) a priority action. This action helps trees grow faster and shortens the time required for stands to become suitable foraging habitat. The Forest Service will use standard silvicultural prescriptions for thinning young stands.

The Forest Service must provide 100 percent of the foraging habitat equivalent for RCW groups whose 1/2 mile foraging zone extends onto another ownership (private, state, or other Federal) unless a cooperative agreement exists with the non-Forest Service landowner.

The Forest Service will provide its proportional share of foraging for RCW groups on adjacent private, state, or other federal ownership but within 1/2 mile of National Forest land, even if no cooperative agreement with the non-Forest Service landowner exists.

The cooperative RCW agreement is a contract that ensures adherence to the Fish and Wildlife Service foraging habitat procedures. This insurance would allow foraging habitat equivalents to be shared in proportion to their availability between the Forest Service and adjacent landowner or agency.

Future Nesting Habitat

A long-term objective of Alternative E is to provide all future nesting habitat across the general forest area through extension of rotation lengths and the designation of replacement stands. However, as long as stands are too young to provide future nesting habitat and RCW populations are small and/or declining, all options described on pages 56-57 will be included to ensure adequate future nesting habitat.

To provide future nesting habitat in the shortest period of time, Alternative E requires retention of the trees (by forest type) on the oldest third of existing acres within the HMA until rotation age, during the first rotation. See page 57 for a possible exception to retention of the oldest third.

In MILs 2 through 4 relict trees should not be removed during thinning operations. An exception would be non-longleaf relicts so closely spaced that threat of southern pine beetle infestation is increased. In such a situation the relicts should be thinned to a minimum spacing of 20-25 feet.

Thinning older stands or young stands with scattered relicts will increase their suitability as nesting habitat. Such thinnings can be used to stimulate colonization and promote population expansion. These thinned stands could also be used to lure RCW groups from a high risk or poor management situation into a location where their habitat can be managed. For example, an RCW group in wilderness or on private land could be lured into an HMA by improving potential nesting habitat along the wilderness or property boundary.

As forest stands approach the age to provide potential nesting habitat, generally 70-100 years depending on pine species, they should be managed to create the optimal stand structure which attracts colonizing RCW - an open, park-like stand with potential cavity trees free from obstruction by midstory or larger stems. They should be thinned to maintain a pine basal area of 60 to 80 square feet and a minimum spacing of 20-25 feet between the dominant and codominant trees. The spacing is actually more critical than the basal area, however if the trees in the stand are greater than 14 inches in diameter, the basal area guideline will provide adequate spacing. Achieving this desirable stand structure may not be practicable in stands managed with an uneven-aged silviculture system.

Thinning

Thinning is an important element of Alternative E. See additional discussion on pages 57-59.

Alternative E will utilize the following thinning guidelines in mature stands (greater than 10 inches diameter):

- Maintain pine basal area of 70-110 square feet, depending on site and stand condition.

- If total pine basal area exceeds 100 square feet, do not remove more than 30 square feet of basal area in any single thinning operation, to reduce potential damage to residual trees.

- The priority for selecting pine trees to remain in MILs 2 - 4 are:

  (1) relict trees
  (2) other potential cavity trees
  (3) trees greater than 10 inches in diameter that are not potential cavity trees
  (4) trees less than 10 inches in diameter

- Trees to remain in MIL 1 should be well formed, healthy, and vigorously growing.

If foraging habitat is limited, thinnings will normally not occur. However, if the density of trees within a stand is extremely high, over 110-120 basal area, or there is a moderate to high risk of southern pine beetle infestations, it may be desirable to thin pine stands to achieve a minimum 20-25 foot spacing while maintaining at least 70 basal area of pine even if foraging is limited.

On occasion, stands of pines may be so dense RCW do not readily use them as foraging. In such situations, it may be desirable to thin these stands back to a basal area of 90 square feet to improve their suitability as foraging, even if foraging is limited.

Over portions of the RCW's range the threat of southern pine beetle infestations is often a factor in making management decisions. A severe beetle outbreak may destroy many acres of RCW habitat in a very short period of time. Therefore, thinning to reduce southern pine beetle hazard is desirable even if foraging may be limited. Such thinnings must be supported by an appropriate southern pine beetle hazard analysis indicating a moderate or higher risk of infestation.

In all cases where foraging is limited, the Forest Service must informally consult with the Fish and Wildlife Service prior to thinning. A site-specific analysis will provide the information base for the consultation, and the decision process must comply with the National Environmental Policy Act, National Forest Management Act, and Endangered Species Act.

As forest stands approach the age to provide potential nesting habitat, generally 70-100 years depending on pine species, the thinning guidelines as previously described above under "Future Nesting Habitat" should be used.

Regeneration and Sustaining RCW Habitat

The Forest Service would emphasize natural regeneration methods and prescribed fire as the primary seedbed preparation method, where site conditions allow. There are many PETS species found in the same habitats as the RCW. Site-specific biological evaluation and environmental accessments are designed to ensure PETS species are protected when vegetation management projects occur.

The Forest Service would use even-aged, two-aged, and uneven-aged regeneration methods, with specific limitations based on MIL that would be more stringent for HMAs with higher risk RCW populations (see pages 59-73).

- Clearcutting is allowed in all MILs to regenerate: Virginia and pitch pine, understocked or damaged stands, and stands being restored to longleaf or other pine species desirable to RCW.
- Shelterwood and seed-tree methods with reserve trees are allowed in MIL 2.
- Shelterwood and seed-tree methods with or without reserve trees are allowed in MIL 1.
- Irregular shelterwood, which reserves the shelterwood trees for an extended or indefinite period, is the primary regeneration method in MIL 3 and MIL 4. Irregular shelterwood produces a two-aged stand.
- Regeneration patch size cannot exceed 25 acres in MIL 3 and MIL 4; patch size cannot exceed 40 acres in MIL 1 and MIL 2. These limitations apply to stands managed with even-aged and two-aged methods.

EVEN-AGED AND TWO-AGED SILVICULTURE

Table 2-E7 shows minimum rotation ages prescribed in Alternative E, and the amount of land which can be sustainably regenerated per decade. Rotation ages for pine-hardwood forest types would be set by the pine species present.

Table 2-E7

Percentage of Area to Harvest by Forest Type and Rotation Length.
The area to be harvested in any decade decreases as the rotation age increases.

Forest Type	Rotation*	Percentage of Area to Regenerate in 10- Year Period
Longleaf pine	120 years	8.3%
Shortleaf pine	120 years	8.3%
Loblolly pine	100 years	10.0%
Slash pine	100 years	10.0%
Loblolly an shortleaf pine (southern pine beetle option) **	80 years	12.5%
Virginia pine	70 years	14.3%

* The Forest Service recognizes there are sites where trees, for various reasons, will not live to the prescribed ages.
** The proposed action includes an optional rotation for loblolly and shortleaf pine where a high probability of southern pine beetle outbreaks or site limitations make tree survival beyond 80 years risky.

The Forest Service would calculate appropriate regeneration acres within an HMA based on:

- The acres of suitable RCW habitat (pine and pine-hardwood forest types with the potential to produce suitable foraging habitat) within the HMA that are identified as suitable for timber management (Land Class Codes 500 and 600).
- The rotation that is applied to each forest type represented.
- The existing acreage of each forest type which is in the 0-10 and 0-30 age classes.
- Additional mitigation measures which are identified and discussed in the following sections on the various harvest methods.
- The MIL of the RCW population in question.

The Forest Service must consider the effects of catastrophic impacts from insect, disease, fire, or weather, when considering age class distribution calculations for planned regeneration. For example, if a tornado destroyed 1000 acres of pine type suitable for timber management within the HMA, that acreage must be included in the 0 to 10 age class, which reduces the regeneration acres. All temporary openings such as cuttings to control southern pine beetle must also be included in the 0-10 or appropriate age class.

Even-aged Silviculture - Clearcut

Alternative E would allow clearcutting within MILs in specific situations. A site specific evaluation must show a definite long-term benefit and no short-term adverse effects on RCW.

The site specific project level evaluation must show:

- Sufficient foraging habitat is available after harvest for each cluster and recruitment stand.
- Foraging habitat is not fragmented by proposed cutting, but is continuous and contiguous with the cluster or recruitment stand.
- Replacement and recruitment stands are not isolated from respective cluster(s) and adjacent clusters are not isolated from each other by the proposed harvest.
- The distribution of age classes should ensure an even flow of habitat is available through time.

These requirements and limitations must be met before clearcutting can occur in any MIL.

There are three specific situations in which clearcutting may be appropriate:

(1) Virginia and pitch pine stands.

The silvical characteristics of Virginia pine and pitch pine make clearcutting the only practical method of regenerating the stand. Virginia pine is shallow-rooted, short-lived, and blows down easily if the stand is opened up. Pitch pine forms branches all along the stem when grown in the open making the tree unsuitable for RCWs. Both species are intolerant of shading and grow well only in the open sunlight such as in old fields or after a catastrophic fire.

(2) Understocked or damaged stands.

Uneven distribution and low basal area are typical for these stands. Natural regeneration is often difficult to achieve under such conditions, thus planting and/or seeding may be necessary.

The Forest Service may clearcut these stands if they have fewer than 24 pine trees per acre 10 inches in diameter or larger. If the existing trees in the stand are desirable for RCW and suitable for the site, the standard mitigation based on MIL would apply. (See Table 2-E8.) For example, the Forest Service must reserve an average of six trees per acre in an understocked or damaged longleaf stand in a MIL 2 HMA.

If the existing trees are an off site species and the stand will be regenerated to a more desirable species, the Forest Service must reserve future cavity trees per the direction below for pine restoration sites.

The Forest Service will prioritize these potential cavity trees in all areas to be clearcut, reserving relicts first. The reserved trees may be clumped, scattered, or a combination of clumped and scattered.

(3) Pine restoration sites.

The Forest Service may also clearcut stands of off site species which are not understocked or damaged to restore longleaf or other desirable pine species. Pine restoration is described in detail on page 54. All existing trees of the species being restored must be reserved to provide potential cavity trees in the near future.

Even-aged Silviculture - Seed-tree or Shelterwood

Alternative E would allow seed-tree and shelterwood methods only in HMAs classified as MIL 1 and MIL 2.

Following is a description of the seed-tree and shelterwood strategies. These descriptions refer to Figures 2-C2 (pg. 140) and 2-C3 (pg. 141) which represent typical loblolly and longleaf pine stands, respectively. The various figures represent an aerial view of stands with specific leave basal areas. They are intended to give the reader an idea of how these leave basal areas may appear on the ground. The figures are based on "average" stands, therefore stands on other sites may differ slightly.

MIL 1: Shelterwood or seed-tree regeneration methods can be used. The seed trees should be vigorous, well formed, and show evidence of past seed production. Once seedlings are established, the seed trees can be removed. The retention of six potential cavity trees per acre in regeneration areas is optional, but encouraged (Figures 2-C2D and 2-C3D). These trees could be clumped (Figures 2-C2D and 2-C3D) or left in larger clumps of one to two acres.

MIL 2: Shelterwood method used. The first removal would leave 25-30 square feet of pine basal area (Figures 2-C2C and 2-C3C). The seed trees should be vigorous, well formed, and show past evidence of seed production. Once seedlings are established, the shelterwood can be removed except the retention of six trees per acre in regeneration areas, which are mandatory. These trees are to provide future cavity trees.

The priorities for selecting these trees are:

(1) relict trees
(2) other potential cavity trees
(3) other trees greater than 10 inches in diameter that meet the requirements for seed producers.

Distribution of these six trees per acre over the harvest area, i.e., clumped, dispersed over the area, etc., is at the discretion of the manager (figures 2-C2D and 2-C3D). These trees are to be retained as long as the RCW population remains in MIL 2.

Two-aged Silviculture - Irregular Shelterwood

Alternative E would allow the irregular shelterwood method in HMAs under all MILs.

Following is a description of the irregular shelterwood strategies for non-longleaf pines. See Longleaf Pine Exception on page 201 for the strategy for that species. These descriptions refer to Figure 2-C2 (pg. 140) which represents typical loblolly pine stands. The various figures represent an aerial view of stands with specific leave basal areas. They are intended to give the reader an idea of how these leave basal areas may appear on the ground. The figures are based on "average" stands, therefore stands on other sites may differ slightly.

MIL 3: The irregular shelterwood method is used. There should be 25-30 square feet of pine basal area per acre left in regeneration areas (Figure 2-C2). These trees are to remain as long as the RCW population remains in MIL 3.

This strategy maintains an element of foraging on the areas regenerated, promotes development of future nesting trees, and reduces the potential for habitat fragmentation.

Trees to be retained as shelterwood should be selected in the following order:

(1) relict trees
(2) other potential cavity trees
(3) other trees greater than 10 inches in diameter that meet the requirements for seed producers.

Distribution of the seed producing trees is the disgression of the manager. When the RCW population increases, meeting the criteria to move into MIL 2, the shelterwood trees may be removed except for six trees per acre required under MIL 2.

MIL 4: The irregular shelterwood is used. The pine leave basal area is to be 40 square feet. Figure 2-C2B illustrates 40 square feet of basal area in loblolly pine. MIL 4 represents the smallest RCW populations, those most vulnerable to extirpation. Therefore, the higher basal area of shelterwood trees is deemed necessary to help insure the population's survival. These trees are to remain as long as the RCW population remains in MIL 4.

Trees to be retained as shelterwood in HMAs in MIL 4 should be selected in the following order:

(1) relict trees
(2) other potential cavity trees
(3) other trees >10 inches in diameter that meet the requirements for seed producers.

When the RCW population increases, meeting the criteria to move into MIL 3, the basal area may be reduced to the 25-30 square feet allowed in MIL 3.

Table 2-E8 summarizes the number of reserve trees/basal area required by MIL.

Table 2-E8
Irregular Shelterwood - Required Number of Reserve Trees by MIL.
Habitat fragmentation effects decrease as the number of reserve trees increases.

Management Intensity Level	Basal Area (Sq. Ft./Acre) of Reserve Trees	Number of Reserve Trees per Acre
MIL 1	0*	0 (6 Optional)*
MIL 2	Not Specified*	6*
MIL 3	25-30**	10***
MIL 4	40**	10***

* Loblolly pine at high risk may be managed on 80-year rotation which requires a minimum of 10 reserve trees (25-30 sq.ft. BA) for MIL 1 through MIL 3 populations.
** Except for longleaf pine which would be subsequently cut to MIL 2 specifications (6 trees/acre) when regeneration is established.
*** In MILs 3 and 4 reserve trees are to be based on basal area, however, not less than 10 trees per acre must be reserved even if the basal area requirement is exceeded.

Longleaf Pine Exception

Longleaf pine is the most intolerant species of southern yellow pine. Growth and development of a new stand is inhibited by shading and competition for moisture and nutrients from surrounding mature trees. The number of reserve trees required in MIL 3 and MIL 4 may greatly retard growth of longleaf seedlings (Boyer 1993).

Alternative E would require leaving the 25 to 30 or 40 square feet of basal area (as shown in Table 2-E8) until the longleaf seedlings are well established, and then reduce the overstory to 10 square feet of basal area, but not less than 6 trees per acre. Using this guideline, stands proposed for regeneration with trees which average less than 17 inches diameter at breast height will require leaving more than 6 trees per acre. For example, an average tree size of 14 inches would require 10 trees per acre, 12 inch trees require 12 trees per acre, etc. The final reserve trees would follow the same priority list as other species. However, the longleaf reserve trees should be clumped to enhance regrowth of the new stand and potential for new clusters (Figure 2-C3D). The longleaf reserve trees would be retained until the HMA was reclassified as MIL 1; if used by the RCW as nest trees they would be retained indefinitely and managed as a cluster.

Loblolly and Shortleaf Pine in High Risk Southern Pine Beetle Areas

Loblolly and shortleaf pine provide habitat for several RCW populations, including some recovery populations. Over much of these species range, they are susceptible to attack by southern pine beetles.

Their susceptibility appears to vary by location within the range. For example, loblolly appears to be more susceptible in the western end of its range. Shortleaf appears to be more susceptible in the coastal plain and piedmont physiographic provinces.

In addition, these two pine species are also affected by site related factors. Some loblolly sites, primarily on old agricultural fields that are badly eroded and thus deficient in nutrients and water holding capacity, may not sustain loblolly, as a stand, to a 100 year rotation.

Shortleaf pine is affected by littleleaf disease, a pathogen which may prevent this species from reaching the recommended 120 year rotation.

Alternative E would offer an option for high risk loblolly and shortleaf pine due to southern pine beetle and/or site related stress. This option is based on an 80-year rotation.

The required silvicultural practices would not change for HMAs classified as MIL 3 and MIL 4. However, in MIL 1 and MIL 2 HMAs a minimum of 25 to 30 square feet of pine basal area (Figure 2-C2C), but not less than 10 trees per acre, would be retained. The overwood would be retained indefinitely, effectively creating a two-aged stand. The reserve trees will be dispersed over the regeneration area, rather than clumped. Any of these residuals remaining after one rotation would be retained through the next rotation.

Stands managed in this manner, although two-aged, over time would develop the appearance of an uneven-aged stand.

This management option may be implemented under the following conditions:

- If historical records indicate the dominant overstory species at the landscape level was loblolly or shortleaf pine.
- If historical records indicate a high probability of catastrophic southern pine beetle outbreaks.
- If soils information indicates a low probability of loblolly pine living, as a stand, to the 100-year rotation age.
- If historical records indicate the presence of littleleaf on shortleaf sites.

UNEVEN-AGED SILVICULTURE

Uneven-aged regeneration methods are allowed in Alternative E. They are previously described on pages 69-73.

MONITORING

Monitoring is an ongoing process of measuring change over time and an essential part of managing projects. Current conditions supply the baseline data which are compared to future conditions. Effective monitoring requires knowing what to measure and how precise these measurements need to be.

The Forest Service uses a three-level approach to monitoring to assure that each project is designed properly, carried out properly, and whether the underlying assumptions used in the design are relevant.

(1) Implementation monitoring

The Forest Service will monitor its projects within HMAs to assure they are implemented according to the standards and guidelines set forth by the RCW Handbook and the affected Forest Plan.

Quality control is necessary to assure the components of a management system are properly designed and implemented on the ground.

The quality control question: Are we doing the job correctly?

For example: A project in an HMA classified as moderate risk (MIL 2) would be limited to 40-acre patch size and at least six potential cavity trees being left per acre of regeneration area. Monitoring would determines if the project employed the standards and guidelines appropriate for a moderate risk population.

(2) Effectiveness monitoring

The Forest Service will monitor its projects within HMAs to determine whether the standards and guidelines are effective.

Systems control is necessary to assure the standards and guidelines set forth in this revised Handbook are effective. The standards and guidelines are based on current knowledge; monitoring is a continuous process to improve our understanding of natural processes and the effects of human activities on those processes.

The systems control question: Are we choosing effective management tools for the job?

For example: Does the 25-acre limit for average patch size and leaving 30 square feet of pine basal area per acre in severe-risk HMAs reduce habitat fragmentation and help RCW populations recover? Have population declines stopped?

(3) Validation monitoring

The Forest Service will monitor its projects within HMAs to determine whether management actions are achieving the desired objectives of the RCW Handbook and affected Forest Plans.

Mission control is necessary to assure the various parts are working together to recover and protect the RCW on National Forest lands.

The mission control question: Is our overall management strategy achieving the objective?

For example: Is the management strategy in severe-risk (MIL 3) areas resulting in an increased RCW population? Are we recovering the species?

All prescribed RCW monitoring activities do not fit neatly into these three categories of monitoring. Because several of the activities can fit more than one monitoring category, no attempt has been made to "pigeonhole" them into any one.

Monitoring would assess whether the proposed standards and guidelines have stabilized RCW population declines and achieved long-term recovery. This would require monitoring both RCW populations and habitat within the HMAs.

Monitoring intensity would be inversely proportional to the size and resilience of the RCW population. The larger, more stable populations will be monitored less intensively than smaller and more vulnerable populations. Alternative E would vary monitoring intensity by population size and trend as shown in Table 2-E9.

Cluster Status and Management-Needs Data Base

The Forest Service has developed a data base that will track group status, cavity use, habitat improvement, treatment accomplishments and needs, cluster conditions, and population survey status. The data base would be updated annually and used to help set treatment priorities, report accomplishments, identify population trends, reproductive success, and describe response to treatments.

Population Monitoring

Population monitoring is necessary to protect and prioritize management action in RCW clusters and determine reproductive success. The Forest Service would monitor RCW populations at intervals determined by population size and trend (See Table 2-E9.)

1) Population Size and Trend

Determine population size and track population trends on an annual basis using sequential periodic surveys of compartments (Hooper and Muse, 1989).

2) Group Check

Check all active and suspected active clusters and count the RCWs in each group, and identify all single bird groups.

This consists of annual roost checks of active clusters to determine presence of birds. Identification of single bird groups is critical. Schedule translocations for single-bird groups. Translocations will require additional monitoring to evaluate success. For short periods this monitoring could be very intensive.

3) Nest Success

Determine nesting success for all groups with two or more birds at the appropriate MIL shown in Table 2-E9 and tally young.

4) Group Survey

Survey all potential RCW nesting habitat in at least 10 percent of the compartments and tally new clusters and groups.

Systematic searches of all suitable nesting habitat in 10 percent of compartments annually will ensure the location of all new clusters and groups. Where possible, pursue cooperative efforts with other responsible agencies to complete surveys of suitable but unsurveyed RCW habitat on lands adjacent to National Forests. Lands within 3/4 mile of the National Forest boundary would be highest priority.

5) Problem Identification

Identify problems affecting any groups potentially caused by flying squirrels, rat snakes, avian competitors, etc.

Identifying competition by other cavity nesters or predators and loss of cavities could help the forests prioritize and schedule work to resolve these problems (remove squirrels, install snake and squirrel excluders, install nest boxes for competitors, etc.).

Habitat Monitoring

Habitat monitoring is necessary to assure that the RCW has adequate nesting and foraging areas to support recovery populations in the future.

6) Cluster Status Check

The Forest Service would survey each cluster (active and inactive) and recruitment stand with artificial cavities at intervals determined by population size and trend (See Table 2-E9). The information would be updated each year and be used to assess management needs and schedule actions that meet those needs. Several pieces of data can be collected on a single visit. Clusters near activities that are potentially disturbing to RCW, such as a timber sale, should be checked during and after the activity is completed.

a) Cavity tree status (active/inactive).

b) Number of usable cavities.

c) Are artificial cavities needed?

d) Are restructures needed?

e) Is prescribed burning needed to control midstory?

f) Is mechanical or chemical midstory control needed?

g) Is the cluster at risk from southern pine beetle attack and require thinning?

h) Are adjacent stands at risk from southern pine beetle and require thinning?

Schedule work to resolve problems identified during the cluster status check. Installation of cavity restructures or artificial cavities require additional monitoring to ensure proper installation, and acceptance by the RCW

7) Compliance check

Determine if standards and guidelines are being followed.

Determine the size of regeneration areas, verify the number of trees and basal area left in regeneration areas, etc., to see if the appropriate standards and guidelines are being met.

8) Effectiveness Evaluation

Determine the effectiveness of RCW habitat improvement.

Verify that prescribed treatments were effective. Did the prescribed burn adequately control the midstory? Did the installation of nest boxes for cavity competitors reduce competition for RCW cavities? Are the prescribed regeneration methods on a wide range of siter growing and developing a new age class as expected? etc.

Table 2-E9 lists the monitoring activities and time frames by population size and trend. The numbered items coincide with the numbered monitoring activities previously listed.

Table 2-E9
Monitoring Activities by Population (Total Active Groups)
The intensity of monitoring activities increases in the small, higher risk populations.

ACTIVITY NUMBER/ DESCRIPTION	POPULATION (TOTAL GROUPS)				
#1/ POPULATION	50	50-99	100-199	200-400	>400
SIZE & TREND	Annually	Annually	Annually	Annually	Annually
#2/ GROUP CHECK	At least 25 annually and all groups in 2 years	All groups in 2 years	All groups in 2 years	All groups in 2 years if decreasing; All groups in 4 years if increasing	20%
#3/ NESTING SUCCESS	At least 25 annually and all groups in 2 years	All groups in 2 years if decreasing; 20% sample but not less than 25 groups annually if increasing	20% sample but not less than 25 groups annually.	Optional if increasing; 20% sample if decreasing	20% for translocation
#4/ GROUP SURVEY	At least 10% compartments w/suitable RCW habitat annually	At least 10% compartments w/suitable RCW habitat annually	At least 10% compartments w/suitable RCW habitat annually	At least 10% compartments w/suitable RCW habitat annually	At least 10% compartments w/suitable RCW habitat annually
#5/ PROBLEM ID	Annually	Annually	Annually if decreasing	Annually if decreasing	N/A
#6/ CLUSTER STATUS CHECK	Annually	Annually if decreasing; All clusters in 2 years if increasing	All clusters in 2 years	All clusters in 2 years if decreasing; All clusters in 4 years if increasing or stable	20%
#7/ COMPLIANCE CHECK	After site-specific projects	After site-specific projects	After site-specific projects	After site-specific projects	After site-specific projects
#8/ EFFECTIVENESS EVALUATION	After site-specific projects	After site-specific projects	After site-specific projects	After site-specific projects	After site-specific projects

SOUTHERN PINE BEETLE HAZARD REDUCTION

Alternative E recommends that thinnings be used to maintain tree vigor and reduce southern pine beetle risk. The Forest Service would thin stands where southern pine beetle hazard was moderate or greater to achieve a minimum 20-25 feet spacing between trees but maintain an overstory pine basal area of at least 70 square feet per acre. Alternative E would follow the standard Southern Region thinning guides (except for RCW tree selection criteria). The Regional thinning guides recommend a range of 60 to 110 square feet of residual pine basal area, depending on site and stand conditions, and the availability of RCW foraging habitat.

Thinning criteria is described in detail in the Habitat Management-Thinnings section of this chapter. The thinning and other means to control southern pine beetle hazard is described in "Managing Southern Forests to Reduce Southern Pine Beetle Impacts" (USDA-Forest Service, Southern Region, 1986).

HABITAT FRAGMENTATION CONTROL

Alternative E includes actions that would limit the potential for habitat fragmentation.

- Extended rotation ages in all MILs.

  The percentage of any HMA in the 0-10 and 0-30 age classes under the new extended rotations will be less than Conner and Rudolph (1991a) found to adversely affect the RCW.

- Prohibiting the regeneration of forest stands within 1/4 mile of RCW groups in MIL 3 and MIL 4.

  The prohibition includes all clearcutting, seed-tree, and shelterwood harvests, even to restore desirable pine species, but allow thinnings to enhance RCW habitat and uneven-aged management, if other applicable guidelines including required foraging habitat, are met.

- Limiting regeneration patch size to a maximum of 40 acres in MIL 1 and MIL 2, and a maximum of 25 acres in MIL 3 and MIL 4.

CLEARING FOR NONTIMBER MANAGEMENT PURPOSES

The removal or clearing of forest cover for oil/gas exploration, developed recreation sites, creating a lake, etc., may create a permanent loss of RCW habitat. Permanent clearing of potential RCW habitat should not occur unless the loss of such habitat would not reduce the capability of the HMA to support its identified RCW population objective.

The Forest Service would evaluate all proposed clearings within HMAs and determine whether they would impact the RCW.

- Clearing would not be allowed if foraging habitat is limited or if the clearing causes a break between the foraging habitat and the cluster or recruitment stand.

- Permanent clearings within 1/4 mile of groups in MIL 3 and MIL 4 should not occur. In situations where mineral rights belong to a party other than the Federal Government, limiting such clearings may be difficult or impossible to enforce.

IDENTIFICATION OF PREFERRED ALTERNATIVE

Alternative E is the preferred alternative.

CHAPTER 3

THE AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

Traditionally, Environmental Impact Statements have presented the Affected Environment and Environmental Consequences as separate chapters. The Affected Environment has generally been Chapter 3 and the Environmental Consequences Chapter 4. In this EIS, Chapter 3 will include both the Affected Environment and Environmental Consequences. The interdisciplinary team preparing this EIS decided to present chapters 3 and 4 together because this allows the most understandable presentation of the material. Information about the conditions and trends of a resource will appear just before the environmental consequences of the alternatives on that resource. If chapters 3 and 4 were presented separately, the length of the individual chapters would make it extremely difficult to comprehend the relationships involved. For example, the disclosure of effects on biological diversity in chapter 4 would be more than 50 pages after the description of biological diversity in chapter 3. This would result in referencing back and forth between chapters 3 and 4, resulting in confusion for the reader.

This chapter presents information about those aspects of the environment that are affected by management for RCW prescribed in the alternatives, with information about its condition, ongoing trends, and interrelationships with other parts of the environment. It also presents direct, indirect and cumulative effects (impacts) of management under the alternatives. It is difficult to assess cumulative affects of management on some resources, particularly red-cockaded woodpecker, vegetation, and biological diversity, because of the long time period involved before affects become evident. For example, in the discussion on effects of prescribed burning on biodiversity, we predict a reintroduction of a more natural fire regime should benefit numerous plants with changes in distribution and abundance. It may take 30 years or more before changes become evident. Monitoring will determine if the predicted effects were correct.

The chapter is organized in three main sections: Biological Setting, Physical Setting, and Social and Economic Setting.

INCOMPLETE OR UNAVAILABLE INFORMATION

The interdisciplinary team examined data, relationships, and scientific literature to estimate effects of the alternatives. There is substantial credible information about the topics of this environmental impact statement, and the basic data and central relationships are well established.

When encountering a gap in information, the interdisciplinary team asked questions implicit in the Council on Environmental Quality (CEQ) Regulations on incomplete or unavailable information: Is this information "essential to a reasoned choice among alternatives?" (40 CFR 1502.22(a)). The interdisciplinary team concluded missing information would frequently add precision to estimates or better specify a relationship. However, basic data and central relationships are sufficiently well established in the respective sciences that new information is very unlikely to reverse or nullify understood relationships. Thus, new information would be welcome, and would add precision. However, it was not essential to a reasoned choice among alternatives as they are written.

It is important to note alternatives incorporate an adaptive management that provides for modification of management should new scientific information warrant such a change.

BIOLOGICAL

The following discussion pertains to the biological components of the environment which may be affected by the proposed action and alternatives. The discussion is presented in five sections including (1) RCW, (2) Wildlife (other than RCW and PETS), (3) Proposed, endangered, Threatened, or Sensitive Species, (4) Vegetation, and (5) Biological Diversity.

Red-Cockaded Woodpecker

OVERVIEW

The red-cockaded woodpecker (Picoides borealis) once commanded a wide range throughout the pine belt of the southern United States. Its range extended from Missouri, Kentucky, and Maryland, southward to Florida, and westward to eastern Texas. Due to losses of foraging and nesting habitat, the red-cockaded woodpecker was placed on the endangered species list in 1970. In years since, suitable habitat has continued to shrink and now the bird's range has been reduced primarily to federal lands (mainly National Forests) in the southern United States.

The species is nonmigratory and individual families or groups maintain year-round territories around their nesting and roost trees (USDI 1985). The bird is a cooperative breeder and helper birds aid the mated pair in the rearing of their offspring (Lennartz and Harlow 1979, Lennartz 1983, USDI 1985, Walters 1990, Walters et al. 1988b, 1992).

Breeding season takes place from April through May with re-nesting attempts and rearing of young taking place as late as August. Clutch size ranges from two to five eggs. (Bent 1939, USDI 1985).

Red-cockaded woodpeckers utilize longleaf, slash, loblolly, shortleaf and Virginia pines as cavity trees. Almost without fail, cavities are in pines that are infected with Phellinus pini or redheart fungus. (Bent 1939, Hooper et al. 1980, Conner and Locke 1982, Hooper 1988, Hooper et al. 1991a, Conner et al. 1994). Redheart fungus is usually not abundant in southern pines until the trees are 80-100 years of age, but the fungus may infect pines as young as 40 years of age (Wahlenberg 1946, 1960, Hooper et al. 1980).

RCW habitat is usually identified as either nesting or foraging habitat. Nesting habitat normally consists of an open, mature pine stand with very little hardwood present in the midstory. When hardwood midstory reaches cavity level, a high rate of cavity abandonment occurs (Hooper et al. 1980, Hovis and Labisky 1985, Loeb et al. 1992). Prescribed burning can be an effective means for controlling small hardwoods (Hooper et al. 1980). Foraging habitat for the red-cockaded woodpecker are pine stands with trees 10 inches in diameter and larger at breast height. The bird sometimes utilizes smaller diameter pines if they are located in proximity to larger, older trees.

PAST ACTIONS THAT HAVE AFFECTED THE PRESENT CONDITION

The Introduction and Chapter 1 of this document describes past management history of the RCW on National Forest System lands.

In summary the Introduction and Chapter 1 state:

There are four primary reasons for decline of the RCW:

1. Hardwood midstory encroachment

2. A shortage of suitable cavity trees

3. Fragmentation and loss of habitat

4. Demographic Isolation

The Forest Service has been involved in RCW management since 1975.

RCW management direction has evolved along with knowledge of the bird's needs.

Two court cases have influenced management of the RCW.

Some RCW populations on National Forest System land are still declining. However, current management, Interim S&Gs, appears to have halted population declines and slowed the rate of decline in most populations.

PRESENT CONDITION OF RCW POPULATIONS AND HABITAT

Although the Interim S&Gs do appear to have slowed and in some cases stopped population declines, most populations are far below their population objectives. For example:

- Only one recovery population (Apalachicola) currently meets Fish and Wildlife Service criteria as being recovered, that is having more than 500 active clusters.

- Two recovery populations (Francis Marion and Vernon) have between 150 and 499 active clusters.

- Three recovery populations (Bienville, Oakmulgee, and Sam Houston) have between 50 and 149 active clusters.

- Six recovery populations (Conecuh, Croatan, DeSoto (Chickasawhay RD), Oconee, Osceola, and Talladega/Shoal Creek) have fewer than 50 active clusters, the minimum necessary for short-term viability, and these face an extreme risk of extirpation.

- Of the 14 support populations on National Forests System lands, 13 have fewer than 50 active clusters.

Forest Service surveys showed 6 of the total 26 populations on National Forests are declining (based on 1993 and 1994 data). This data indicates 23 percent of populations declining, compared to 67 percent decreasing in 1989. This indicates the Interim S&Gs are having a positive effect.

The condition of RCW habitat on the 11 National Forests which have RCW is quite variable. Only 10 percent of the pine and pine/hardwood stands on these forest are old enough to provide potential cavity trees (81 years or older). Most existing RCW cavities are in relict trees, those trees left after the massive timber harvest of the 1920s and 1930s. Some forests such as the Apalachicola and the Vernon Ranger District of the Kisatchie have some relict trees remaining. Other forests, such as the DeSoto and Conecuh, have very few. The presence of adequate potential cavity trees, in the form of relicts, is an important factor contributing to the large number and relative stability of the RCW on the Apalachicola and Vernon. Conversely, the lack of relicts on the DeSoto and Conecuh has contributed to the continued decline of RCW on these forests. Conner et al. (1991a) stated cavity tree mortality exceeded the rate at which new cavities were being created in east Texas. Relict tree availability is critical to help offset cavity tree mortality.

Dense hardwood midstory is a major cause of cluster abandonment (Hooper et al. 1980, Hovis and Labisky 1985, Loeb et al. 1992). The exclusion of fire from the southern National Forests for many years has resulted in the development of such midstories in many stands. All active and some inactive clusters have now had midstory control completed. However, very little of the RCW's remaining habitat has had any kind of midstory treatment. This lack of midstory treatment in foraging habitat can be of some importance. Female RCW show a strong preference for foraging on the trunks of the pine trees (Hooper and Lennartz 1981). In stands with tall, dense midstories, a significant portion of the female's preferred foraging area may be unavailable and in some cases avoided (Rudolph and Conner, unpublished data).

Range-wide existing RCW habitat is severely fragmented. This fragmentation is primarily a function of land ownership patterns and land uses. Little private forest land is managed in a way to provide RCW habitat. This condition is not likely to change.

The National Forests, which support 51 percent of the known active RCW groups (F.C. James, unpublished data), are isolated islands of habitat. Fortunately, many National Forests are large enough to support genetically viable RCW populations.

Fragmentation of habitat within the National Forests is on a smaller scale and is primarily a function of past management practices, both for timber and the RCW. Such fragmentation of habitat can result in demographic isolation of clusters, resulting in inadequate interchange of birds between clusters and/or subpopulations to maintain population size and genetic viability. Such demographic isolation usually results in population declines. Fortunately, this type of fragmentation will be resolved with time, as these previously regenerated stands grow older and again become suitable RCW habitat.

SCOPE OF ANALYSIS

This analysis focuses on effects of the proposed action and various alternatives on the RCW and its habitat relative to recovery of the species. This section also describes expected effects the recommended changes in forest management will have on recovery of RCW.

DISCLOSURE OF EFFECTS

The objective of the proposed action and alternatives is recovery of the RCW. Implementing the various management activities identified in Table 2-4 may result in direct, indirect, or cumulative effects on the RCW or its habitat. The degree of effect is dependent on the specific activity and the timing and intensity of application.

The following disclosure of effects address those management activities which are most critical to recovery of the RCW.

HABITAT MANAGEMENT AREA DESIGNATION

Direct, Indirect, and Cumulative Effects

There would be no direct effects on RCW from designating HMA's.

The following indirect and cumulative effects may occur:

Alternative A: Habitat management areas would be 3/4-mile radius circles around active and inactive clusters. In large, dense populations with overlapping circles, adverse effects should be minimal. RCWs would essentially be protecting their habitat and corridors for dispersal by their existing population densities. RCW populations where 3/4-mile circles do not overlap may be adversely affected as the area between 3/4 mile circles are regenerated. Habitat may become fragmented, clusters could become isolated from one another, and the populations may decline. Approximately 1.4 million acres of pine and pine-hardwood forest would be included within the 3/4-mile radius circles.

The cumulative effects of managing RCW habitat in 3/4-mile radius circles around clusters has the potential for continual fragmentation of habitat between 3/4-mile circles. There is also a high probability of short rotation and habitat modification on adjacent private and corporate lands (USDA 1988). The combination of short rotation and habitat modification on private lands and the likelihood of habitat fragmentation outside 3/4-mile zones may lead to demographic isolation of RCW groups. As the groups become more isolated, there may be a collapse of the population because dispersing birds fail to find mates and suitable nesting habitat. The potential effects would be most severe in smaller populations (Conner and Rudolph 1991a).

Alternative B: In Alternative B, HMAs are not identified. Management of RCWs is based on active clusters and adequate acres of foraging habitat adjacent to each cluster to provide the necessary number of foraging stems. Opportunities for habitat fragmentation and cluster isolation are greatest in this alternative. There is a high probability of adverse effects on population stability and expansion, caused by demographic isolation. The greatest potential for adverse effects is in the small populations. Approximately 125 thousand acres of pine and pine-hardwood forest would be included in clusters. Now that foraging is based on number of stems, it is not possible to realistically estimate the total acres which will be allocated to RCW management.

The cumulative effects would be similar to Alternative A, except there is a much greater probability of habitat fragmentation and demographic isolation due to the much smaller area around each cluster being managed specifically for RCW. This could lead to population declines again, with the most serious effects in the smaller population.

Alternatives C-E: Establishing HMAs in these alternatives would allow an ecosystem approach to RCW recovery. HMA size is dependent on population objectives and habitat quality. HMAs would contain a minimum of 6,150 acres of contiguous suitable habitat. The continuity of RCW habitat over large areas should preclude isolation of clusters and allow for good dispersal of RCWs across the habitat. An estimated 2 million acres of pine and pine-hardwood forest will be included within RCW HMAs.

Cumulative effects of establishing HMAs should all be positive. An ecosystem approach should allow RCW social interaction at the landscape level which should help in successful dispersal of subadults. The inclusion of private lands within HMA boundaries may lead to some habitat fragmentation, but it should not lead to demographic isolation.

TENTATIVE HMA DELINEATION

Alternatives C, D, and E: Tentative HMAs will be established through the Record of Decision. They will remain in effect until individual Forest Plans are amended or revised to incorporate the new RCW management direction.

Tentative HMAs will reduce the potential for RCW habitat fragmentation in the areas between the 3/4-mile radius circles covered by Interim S&Gs. They will also maintain future management options within these areas because allowed regeneration methods retain adequate basal area to allow implementation of a full range of silvicultural systems.

Designation of tentative HMAs is critical to RCW recovery efforts given the two-step process (described on page xxxvii), being used to implement the new RCW management direction.

MANAGEMENT INTENSITY LEVEL DESIGNATION

There are no direct, indirect, or cumulative effects based on MIL designation. MILs do affect other management actions which could have direct, indirect, and cumulative effects and will be addressed later.

ESTABLISHING REPLACEMENT AND RECRUITMENT STANDS

Direct, Indirect, and Cumulative Effects

There will be no direct effects from establishing replacement or recruitment stands.

Establishment of recruitment stands in areas below the population objective should be beneficial in all alternatives. Their benefit will be greatly enhanced by the addition of artificial cavities. Potential nesting habitat and the associated foraging habitat would be managed to enhance population expansion. Recruitment stands are optional in MIL 1 and 2 of Alternatives C and D and in MIL 1 of Alternative E. RCW populations at these management intensity levels are large and increasing or recovered. At these population levels, it is believed rotation length should provide adequate suitable nesting habitat for population expansion and/or maintenance.

Replacement stands are identified in all alternatives and should have beneficial effects. Alternative A requires replacement stands for all active and inactive clusters. There would be no adverse effect from identifying replacement stands for inactive clusters, but it is not biologically necessary. Alternative E requires replacement stands for all active clusters.

There should be no adverse cumulative effects from establishing replacement and recruitment stands. Populations should respond to the sustained availability of suitable nesting habitat for population expansion and maintenance.

MIDSTORY REMOVAL, CONTROL, AND REDUCTION

Direct, Indirect, and Cumulative Effects

There will be no direct effect to RCW of hardwood midstory reduction/control in any alternative.

Alternative A: Approximately 100,000 acres associated with clusters would be treated to remove and control hardwood midstory. In addition, approximately 1.3 million acres within the 3/4-mile circles would be treated to reduce hardwood midstory. The hardwood midstory removal, and reduction would improve the quality of RCW habitat. It could also make more foraging substrate available for the females with a possible improvement in reproductive success.

In stands (clusters) with a large number of hardwood trees in the canopy, removal of all or a significant number of these trees could increase the susceptibility of cavity trees or other pines to windthrow.

Pine midstory is always present in balanced uneven-aged stands and for 20-30 or more years in two-aged stands. Control of the pine midstory will prevent development of the new size classes needed for future habitat.

Alternative B: Approximately 125,000 acres associated with clusters would be treated to remove and control midstory. There is no requirement to do any type of midstory control or reduction outside the clusters. Quality RCW habitat would be produced on approximately 11 percent of the acres in Alternative A. This could reduce the potential for reproductive success.

Potential for windthrow of cavity trees is the same as Alternative A.

Alternatives C-E: Approximately 200,000 acres would receive midstory removal and control treatments. Within the HMAs, another 1.8 million acres would receive some level of midstory reduction. These treatments will create approximately 30 percent and 94 percent more acres of quality RCW habitat than Alternatives A or B respectively, with a potential increase in reproductive success.

Potential for windthrow of cavity trees is the same as Alternative A.

CAVITY RESTRICTORS

Restrictors are used to protect existing cavities (natural or artificial) from being enlarged by competing woodpeckers and to repair cavities that have been enlarged by competing cavity nesters. Restrictors are utilized in all alternatives and the effects are the same.

Direct, Indirect, and Cumulative Effects

There will be no direct effects on RCW from the installation of cavity restrictors.

There is a possibility of positive and negative effects under all alternatives. Negative effects could occur if an RCW did not accept its cavity after the restrictor was installed or if the entrance hole in the restrictor was too small. There is one documented case of a RCW getting its leg caught under the edge of a restrictor and dying. To ensure these potential negative effects do not occur, additional monitoring is required after installation of restrictors. If individuals do not accept the restricted cavity or can't fit into the entrance hole, restrictors should be removed, repositioned, or the entrance hole in the restrictor should be enlarged. To prevent RCW from being trapped and killed, care should be taken during installation to ensure any gaps which could trap a RCW are hammered flat against the tree. Intensive monitoring should continue.

If RCWs accept restricted cavities, all indirect and cumulative effects would be positive for all alternatives. The stainless steel restrictors would preclude cavity enlargement by any competing woodpecker, thus providing more useable cavities for RCW. The restrictors do not exclude southern flying squirrels, a known nest competitor of the RCW (Carter et al. 1989, Loeb 1993). Use of restrictors would help protect existing cavities allowing RCWs to spend more energy on nesting, brood rearing, and foraging; adding to the overall health of the group and ultimately the population.

TRANSLOCATION

Translocation, the trapping and moving of RCW from one locale to another, is a critical element of all alternatives.

Direct, Indirect, and Cumulative Effects

There is potential for an adverse direct effect. Translocation involves the capture, banding, and transportation of individual RCW's. These activities place the RCW under some stress and there is potential for mortality. However, from 1989 through 1993, 85 RCWs have been moved without a single death.

Indirect effect on donor populations should be negligible, even though that population will be reduced by the number of RCW removed. Subadult RCWs used for translocation are usually taken from the more densely populated portions of larger more stable populations. They are not needed to maintain genetic viability nor population levels in the donor population. In a study in North Carolina, Walters et al. (1988b) determined 57 percent of fledgling males and 68 percent of fledgling females were disappearing from the population. Translocation efforts would utilize birds that normally would be disappearing from the population.

In recipient populations, indirect effects are positive. Assuming the translocation is successful, i.e., the birds pair, the number of single bird groups is reduced. The potential for genetic viability is increased as a result of new genetic material being introduced into the population. The creation of a new breeding pair could result in increased reproduction. All of these elements contribute to the achievement of the population objective and eventual recovery.

Cumulative effects should ultimately lead to recovery. Translocation requires large amounts of monitoring of clusters and reproductive outputs in donor populations. If monitoring efforts indicate a loss of active clusters or reduced reproductive outputs in donor populations, translocation efforts would be scaled back so adverse cumulative effects do not occur to donor populations.

Cumulative effects on recipient populations should be a steadily increasing RCW population. This increase is caused by the addition of individuals through translocation and reproduction from within the population. Translocation will play a critical role in recovery of the RCW. Limiting factors would be available suitable nesting habitat and the availability of subadults for translocation.

ARTIFICIAL CAVITIES

Artificial cavities are critical to recovery of the RCW and will be used in all alternatives. Both drilled cavities and cavity inserts may be utilized.

Direct, Indirect, and Cumulative Effects

There will be no direct effects on RCW from installing artificial cavities.

Artificial cavities will be needed to provide cavities until existing stands of trees get old enough to provide natural cavities. They will also be used to provide new cavities for those lost to mortality or catastrophic events, such as Hurricane Hugo. Their use in conjunction with recruitment stands will greatly speed up population expansion and lead to more rapid recovery of the RCW.

Use of artificial cavities to increase the number available in each cluster could also reduce the competition for cavities by competing cavity users.

The above uses will contribute to sustaining and/or increasing RCW numbers. This in turn will result in quicker recovery of the species.

HABITAT MANAGEMENT

THE FOLLOWING DISCUSSION OF HABITAT MANAGEMENT ACTIVITIES AND THEIR EFFECT ON THE RCW PERTAIN TO THE AREA WITHIN RCW HMAS BUT OUTSIDE CLUSTERS, REPLACEMENT, AND RECRUITMENT STANDS.

PRESCRIBED BURNING

Prescribed burning is a valuable tool for the RCW manager. It is used in all alternatives. Effects would be similar in all alternatives; the differences are associated with magnitude of treatment area. Alternative B treats primarily clusters, replacement and recruitment stands, approximately 125,000 acres. All other alternatives treat all RCW habitat, resulting in more RCW benefits. Alternative A treats approximately 1.4 million acres and Alternatives C-E treat approximately 2.0 million acres.

Direct, Indirect, and Cumulative Effects

An example of a direct effect of prescribed burning would be a cavity catching fire while occupied by an RCW, nestlings, or eggs.

There is the potential to lose cavities (without directly affecting the RCW) to prescribed burning. There is also the potential to stress nestlings during prescribed fires in the nesting season. Heat, smoke, and disruption of feeding patterns by adults are all sources of stress. Stamps et al. (1983) stated, prescribed burning during the nesting season apparently did not affect nestling survival.

There are studies which suggest any treatment to control midstory would be beneficial to the RCW by providing higher quality habitat, both nesting and foraging (Hooper and Lennartz 1981, Wood 1983, Rudolph and Conner, unpublished data). Prescribed burning is the most cost-effective tool to accomplish this desired habitat condition.

As burning programs continue and fuels are effectively managed, the possibility of cavities catching on fire is reduced. Control of midstory in foraging habitat would allow any stand, old enough, to function as potential nesting habitat. As more forests establish effective burning programs, RCW populations should increase (Costa and Escano 1989, Hooper et al. 1991b).

PINE RESTORATION

RCW clusters, recruitment stands, and replacement stands which contain off-site species will not be regenerated until these areas become unsuited as nesting habitat.

This activity involves the reestablishment of desirable pine species, including but not limited to longleaf and shortleaf pine, on sites currently occupied by other pine species. It is allowed and/or encouraged in all alternatives. The primary regeneration method used to restore pine species will be clearcutting.

Direct, Indirect, and Cumulative Effects

The direct effects of clearcutting are essentially the same in all alternatives. The removal of all trees in a single cutting operation makes the stand unsuitable as RCW habitat for a period of time. Alternatives A, C, D, and E require the retention of some reserve trees (tall forest cover) if present in all situations where restoration of desirable pine species is allowed, as mitigation. These trees, (where available, usually not less than six per acre) will provide some foraging and potential cavity trees. The trees being left in the stand should be of the species being restored. Trees should not be left in restoration areas if they are not the species being restored. Alternative B does not require retention of such cover.

Removal of all or most of the trees in a stand in a single cutting operation results in that stand being unsuitable as RCW habitat for 20 to 40 years, depending on site quality. In those alternatives which prescribe retaining (where available) older trees of the species being restored, parts of the stand being regenerated may remain usable by the RCW to a small degree. When the younger stand reaches foraging size, some of the scattered older trees, may be suitable as potential cavity trees.

Restorations will have a definite long-term benefit to RCW because the pine species being restored usually live longer, are more resistant to insects and disease, and are frequently preferred by the RCW. This results in higher quality RCW habitat in the long-term. Although clearcutting has more potential to fragment RCW habitat than other regeneration method, with the rotations recommended in alternatives A, C, and E, the percentage of area which could be regenerated in each 10-year entry period is not likely to have an adverse effect. The number of acres to be regenerated each entry (shorter rotations) in Alternative B is more likely to cause adverse fragmentation of the habitat if the regeneration areas are improperly located.

Alternative E allows for increased rates of restoration in unoccupied RCW habitat. Unoccupied habitat is defined as habitat beyond 1.5 miles of an active cluster. For the first 20 years of implementation, up to 15 percent of suitable habitat can be in the 0-10 age class and up to 40 percent in the 0-30 age class, when harvests that resulted in these age classes are tied directly to restoration. The indirect effects of increased rates of restoration will be reduction in the amount of potential foraging habitat in areas beyond 1.5 miles of active clusters. Because these reductions would be occurring in unoccupied habitat, there should be no effect to the RCW (Conner and Rudolph; Hooper; Walters; personal communication). Potential nesting habitat would not be affected by the increased rates of restoration because sufficient recruitment stands to meet population objectives would have been identified prior to any restoration efforts. This would protect the best potential nesting habitat. The cumulative effects of increased rates of restoration would be quicker completion of restoration of pine species more desirable to the RCW, resulting in long-term habitat improvements across the landscape.

FORAGING HABITAT MANAGEMENT

In addition to providing an adequate number of pine trees of the appropriate age and size, there are two more key elements of good RCW foraging habitat. These are tree spacing and a lack of significant midstory. There are two primary tools used to accomplish the desired foraging habitat condition. Prescribed burning is used to control midstory, and thinning is used to maintain proper tree spacing. Clusters are considered foraging habitat. In addition the type of regeneration methods used also affect stand structure.

Direct, Indirect, and Cumulative Effects

The effects of prescribed burning and thinning on RCW and its habitat are discussed on pages 219 and 226 respectively.

Stands managed with even-aged methods, once reaching appropriate size, are readily for prescribe burning to aid in control of midstory. Even-aged stands will normally grow to foraging size in fewer years than two-aged or uneven-aged stands.

Stands managed with two-aged and uneven-aged methods are often difficult to burn without damaging or destroying the pine regeneration necessary to perpetuate the stands. In addition, pine midstory is present for 20-30 years in two-aged stands and indefinitely in uneven-aged stands. This pine midstory is inevitable if the stands are to be perpetuated, and it could reduce the quality of foraging habitat.

Alternative E would allow a reduction of foraging habitat, in unoccupied habitat, to aid in pine restoration. Recruitment stands beyond 1.5 miles of active clusters would have at least 3,175 pine stems ≥ 10" DBH and at least 30 years old, and a minimum of 4,250 square feet of pine basal area as foraging habitat. This amount of foraging habitat should sustain an RCW group if it were to activate one of these recruitment stands, until a full complement of foraging habitat could be provided (Conner and Rudolph; Hooper; Walters; personal communication). There should be no adverse indirect effects of reducing foraging habitat for recruitment stands in unoccupied habitat. The cumulative effects would be an increased rated of restoration resulting in long-term habitat improvements across the landscape.

FUTURE NESTING HABITAT

Preferred nesting habitat is open, park-like stands with no or little midstory and basal areas ranging from 60-80 square feet per acre. On highly productive sites, basal areas would be higher and tree spacing becomes more critical. Thinning and prescribed burning are the key tools in managing nesting habitat to meet preferred structural conditions. As with foraging habitat, the regeneration method used does affect stand structure.

Direct, Indirect, and Cumulative Effects

The effects of prescribed burning and thinning in developing and sustaining future nesting habitat are the same as described on pages 219 and 226.

The open, park-like stands preferred by RCW can be more easily provided in even-aged stands. Two-aged stands will have a pine midstory for 20-30 years, reducing their suitability as potential nesting habitat unless this midstory pine vegetation is managed to control spacing.

Stands managed with uneven-aged methods, by necessity, have a pine midstory indefinitely. This is especially true of loblolly and shortleaf pine. This midstory reduces these stands' suitability as nesting habitat.

HABITAT MANAGEMENT CRITERIA

Planned regeneration and establishment of pine and pine-hardwood stands and subsequent thinnings are necessary to provide a sustained uniform flow of RCW foraging and nesting habitat through time. Application of appropriate rotations to ensure an adequate supply of potential cavity trees is key to recovery of the RCW. It must be recognized some sites may only be capable of producing foraging habitat. These sites do not have the capability to produce potential nesting habitat or may only sustain it for a short period of time. This section will discuss the effects of the rotations recommended in the proposed action and various alternatives on the RCW and its habitat.

Rotations

Following are the direct, indirect, and cumulative effects of establishing and implementing the rotations prescribed in the proposed action and various alternatives.

Direct, Indirect, and Cumulative Effects

There will be no direct effects of establishing rotations under any alternative. Setting a rotation length will not have a direct effect on habitat. There will be indirect and cumulative effects.

Rotation age (80-, 100-, and 120-year) had a significant effect on the numbers of loblolly pine cavity trees, but the effect was not consistent among regeneration methods analyzed. With the Irregular Shelterwood Method (no planned removal of the parent trees), the number of potential cavity trees decreased with increasing rotation age. This decrease in loblolly pine potential cavity trees resulted from increasing mortality of the retained parent trees and decreasing acres in each age class as rotation age increased. With all other methods, the number of loblolly pine potential cavity trees increased as rotation age increased (Walker 1995).

Rotation age (80-, 100-, 120-, 150-, 200-, and 250-year) did have a significant effect on the number of longleaf pine potential cavity trees provided, but this effect was mainly expressed in rotations less than 150 years. With 150-year and longer rotations, there was little change in the number of longleaf pine potential cavity trees within any of the methods. The longer the rotation, the older the potential cavity trees (Walker 1995).

Walker (1995) reports, "Regardless of the effect of rotation age on numbers of potential cavity trees, there is little doubt that the quality of such trees increases with increasing age. However, there is some possibility that beyond a certain (but unknown) age the quality of loblolly pine as potential cavity trees decreases (Baker 1983)."

The following disclosure of effects assumes balanced age and/or size classes and no catastrophic events.

Alternative A: Within 1/4-mile zones, there is no planned regeneration except for the restoration of longleaf pine. Eventually, most stands would usually be regenerated naturally over a long period of time as they reach pathological rotation. Off site species and species on poor quality sites would likely die at a more rapid rate. The accelerated rate of habitat loss could decrease available foraging habitat, potential nesting habitat, and may lead to habitat fragmentation and cluster isolation. Areas restored to longleaf pine should provide RCW habitat for longer periods of time than where off site species are retained.

Within the 1/4- to 3/4-mile zones, there may be sites where the 120-year rotation is too long for the species present, due to site quality. These stands will be randomly lost and could cause habitat fragmentation, cluster isolation, and a decrease in foraging habitat. Some sites may not be capable of producing nesting habitat and will only provide foraging habitat. On sites capable of growing trees to 120 years, habitat fragmentation and cluster isolation should be minimized within the 3/4-mile radius circles. Foraging habitat should also be available.

Alternative B: With an 80-year rotation for longleaf and a 70-year rotation for the other yellow pines, it is doubtful many stands would degenerate before reaching rotation. There may be a few areas of off site pine that may have significant mortality before reaching rotation, but there should not be enough to create fragmentation and cluster isolation.

Alternative C: This alternative proposes rotation ranging from 60 to 200 years depending on species and site index. With these rotations, off site species and loblolly and slash pine on poor quality site could sustain severe damage prior to reaching rotation age. The random loss of these stands could cause cluster isolation and foraging habitat fragmentation in some compartments, but usually less than Alternative A. Some stands of shortleaf and longleaf pine could be damaged before reaching rotation age at 150 - 200 years.

There is substantial evidence to suggest that trees become more susceptible to high winds as age increases (Hooper and McAdie 1995). Therefore, extremely long rotations, such as the 200-year rotation recommended in Alternative C could result in a cumulative adverse effect by placing a large percentage of an HMA in the age classes which appear to be more susceptible to high winds. Hurricane Hugo impacted stands 50 years old and older to a higher degree. Using the 200-year rotation as an example, 75 percent of an HMA would be in stands very susceptible to high winds. In the event of a catastrophic storm, a significant portion of RCW habitat may be lost, making recovery more difficult.

Alternative D: This alternative does not have planned regeneration, therefore no rotation or regulation. As trees grow older, the stands that are off site and slash and loblolly pines on poor sites, will likely degenerate at an accelerated rate. Because there is no planned regeneration, all sites will eventually degenerate.

Some sites may become dominated by hardwoods. As trees are lost at an accelerated rate and hardwoods become more dominant, habitat may become fragmented, clusters could become isolated, and RCW populations may decline. Because there is no planned regeneration, there will not be sustained flow of RCW habitat through time. Long-term RCW stability may not be possible because regeneration is dependent on only natural forces.

Alternative E: This alternative proposes a 120-year rotation for longleaf and shortleaf pine, an optional 80-year rotation for loblolly and shortleaf, a 100-year rotation for loblolly and other yellow pines, and a 70-year rotation for Virginia pine. There may be some mortality of trees that are off site or loblolly and slash pines on poor sites. Some sites may not be capable of producing suitable nesting habitat. With the rotations proposed in this alternative, foraging and nesting habitat should not be limited and fragmentation should be minimized.

The 80-year rotation in loblolly and shortleaf is allowed only in areas where the risk of southern pine beetle infestation is high or the site is not capable of sustaining these species as a stand until rotation. The retention of 25-30 square feet of basal area indefinitely is required as mitigation for regenerating the stands just as they are reaching an age suitable for cavity excavation.

Figures 3-1 and 3-2 summarize the effect rotation and regeneration method has on the production of potential cavity trees for loblolly and longleaf pine, respectively.

Figure 3-1

Effect of rotation and regeneration method on number of potential cavity trees-loblolly pine.
Number per 1,000 acres of potential loblolly pine cavity trees (≥ 18 inches DBH and ≥ 70 years old) by age classes for different regeneration methods and different rotation ages. CC = Clearcut; SW = Shelterwood; SW-20% Cl = Shelterwood with 20% in Clumps; 40SR - Irregular Shelterwood - 40 Basal Area - Staged Removal - 20% in Clumps; 40NR - Irregular Shelterwood - 40 Basal Area - No Removal - No Clumps; 30NR = Irregular Shelterwood - 30 Basal Area - No Removal - No Clumps; G Sel = Group Selection; S-T Sel = Single-Tree Selection. See text for explanation of regeneration methods.

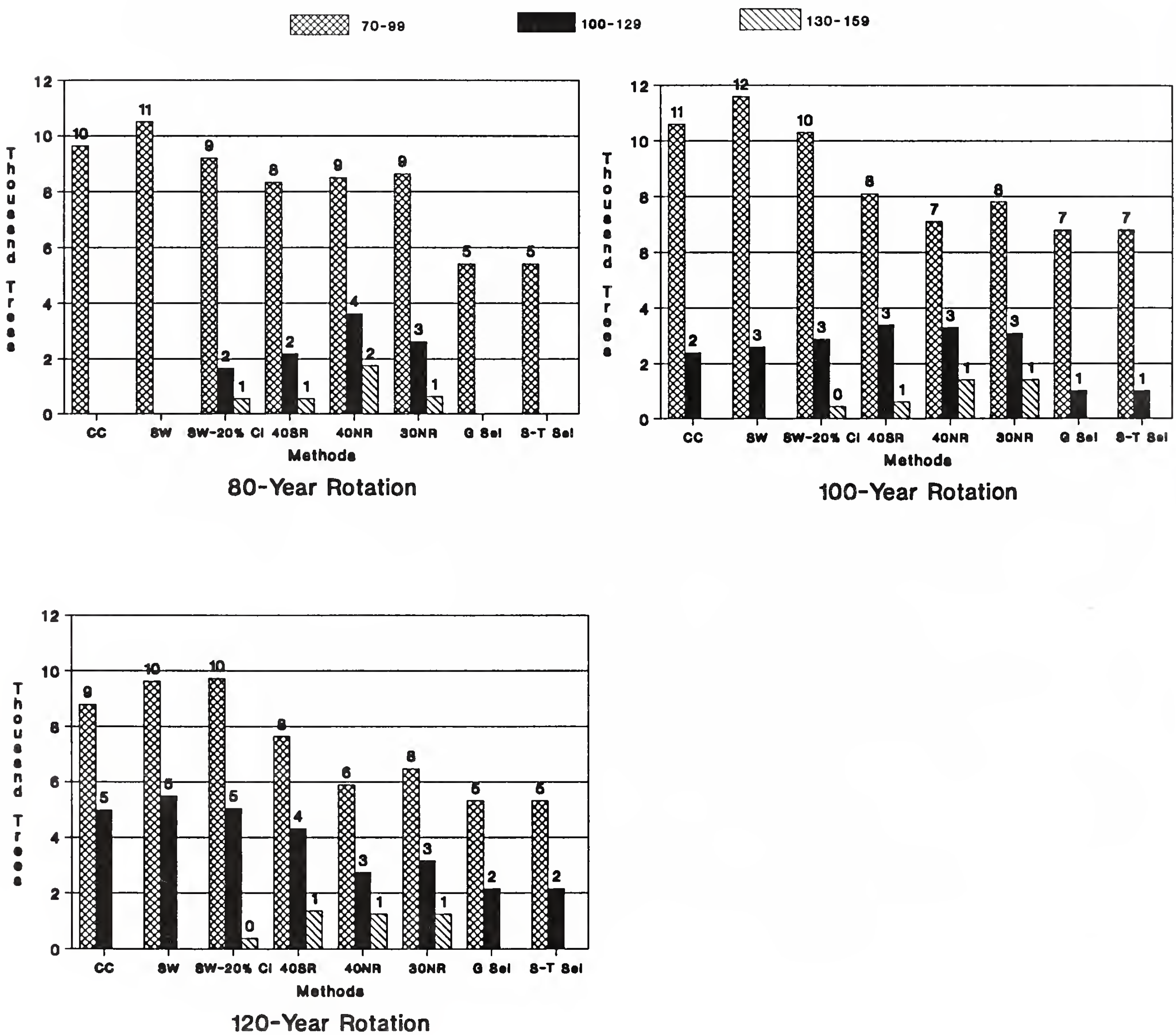
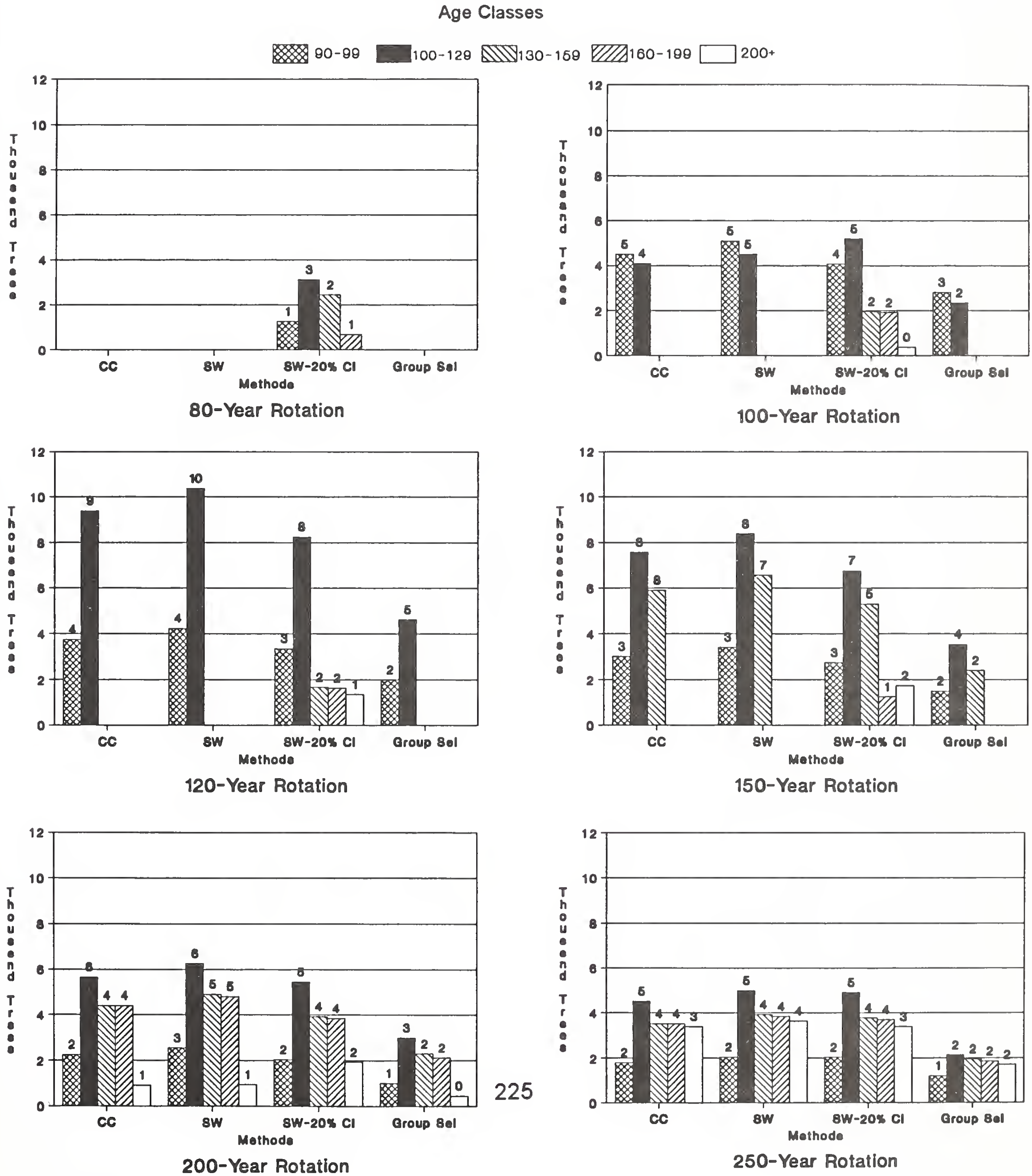


Figure 3-2

Effect of Rotation and Regeneration Method on Number of Potential Cavity Trees-longleaf Pine.
Number per 1,000 acres of potential longleaf pine cavity trees (≥ 15 inches DBH and ≥ 90 years old) by age classes for different regeneration methods and different rotation ages. CC = Clearcut; SW = Shelterwood; SW-20% CL = Shelterwood with 20% in Clumps; Group Sel = Group Selection. See text for explanation of regeneration methods.



THINNING

Thinning of forest stands is a key activity in the production of quality RCW habitat.

Direct, Indirect, and Cumulative Effects

The direct effect of thinning stands containing foraging size trees is the reduction in numbers of foraging size trees.

Thinning in stands old enough and large enough to be foraging habitat usually maintains or increases tree vigor and stand health. Thinning to reduce the risk of southern pine beetle infestations may have a positive effect. Failure to reduce tree spacing to reduce southern pine beetle risk could result in an infestation which could reduce the available foraging to a much lower level than the thinning necessary to prevent such an occurrence.

In young stands not yet considered foraging habitat growing on an adequate site, thinnings will enhance their growth, shortening the time for them to reach the desired 10-inch diameter for foraging. In addition, this improves the spacing between trees by reducing stem density.

The types of trees which remain after a thinning (leave trees) can have an indirect effect on the RCW and its habitat. These leave trees vary by alternative. Alternatives A and C-E require that relict trees and other potential cavity trees be left. Alternative B requires that well formed, healthy, and vigorously growing trees remain. The leave tree priorities in Alternatives A and C-E increase the probability that potential cavity trees will be produced in a shorter period of time. The leave tree priorities for Alternative B may take many more years to become potential cavity trees.

Thinning, if conducted regularly throughout the life of the stand, reduces the risk of southern pine beetle infestation, speeds up the development and sustains suitable foraging and nesting habitat, and contributes to the stand's ability to withstand high winds (Hooper and McAdie 1995). The latter is especially important in coastal plain populations susceptible to hurricanes. All of these effects would be beneficial to the RCW.

REGENERATION

Regeneration is the establishment of a new age class of trees in a forest. It involves replacing old trees with new ones of the desired species. Regeneration of southern yellow pines can be accomplished in a variety of ways. Following is a discussion of the various regeneration methods allowed in the proposed action and the alternatives and how they affect the RCW and its habitat.

The spatial arrangement of potential cavity trees and foraging habitat varies between regeneration methods and rotation ages primarily because of stand structure and tree longevity.

RCW clusters, recruitment stands, and replacement stands are not planned for regeneration and are therefore not harvested.

Even-aged Silviculture - Clearcut

The effect of clearcutting on the RCW and its habitat on a unit area basis is the same for all alternatives.

Direct, Indirect, and Cumulative Effects

Alternatives A, C, D, and E require the retention of certain reserve trees (where present), where clearcutting is allowed, as mitigation. These reserve trees, if present either singly or in clumps, will be randomly scattered across some stands. Alternative B does not require retention of such reserve trees.

Removal of all or most trees in a stand in a single cutting operation results in that stand being considered unsuitable as RCW foraging habitat until the stands reach the 10-inch diameter class. This may take 20 to 40 years, depending on site quality and density of trees. In those alternatives which require retention of reserve trees (tall forest cover), part of the stand may remain usable by RCW to some degree.

Although clearcutting has more potential to fragment RCW habitat if improperly located than other regeneration methods, with the rotations recommended in Alternatives A, C, and E, the percentage of area which could be regenerated in each 10-year entry period is not likely to result in fragmentation. The numbers of acres to be regenerated each entry in Alternative B if improperly located are more likely to cause adverse fragmentation of the habitat.

A forest with balanced even-aged stands managed using the clearcut, seed-tree, and shelterwood methods would have stand size areas (10+ acres) of potential cavity trees, foraging habitat, and 0-30 year age classes scattered over the forest.

Forests managed with balanced even-aged stands provided more potential cavity trees and foraging habitat than two-aged and uneven-aged forests. Even-aged systems are more easily implemented and allows essential control of hardwood midstory by use of fire without damaging younger age classes of pines (Walker 1994). See additional discussion under Vegetation for the clearcut method on pages 257-258.

Even-aged Silviculture - Seed-tree or Shelterwood

The seed-tree and shelterwood methods of regeneration involve removal of trees in a stand in a series of cuttings (usually two or three) over a relatively short portion of the rotation, where establishment of essentially an even-aged stand under the seed trees is encouraged. Alternative A, C (MILs 3-5), D, and E (MILs 3-4) do not allow standard seed-tree on shelterwood regeneration harvests.

Direct, Indirect and Cumulative Effects

In Alternatives B, C, and E the direct effect of the initial harvest of a shelterwood or seed-tree cut on RCW will be minimal. In seed-tree cuts, 6-12 square feet of basal area per acre will remain and in shelterwood cuts, 20-30 square feet of basal area per acre will be left. Such stands will retain some level of suitability as RCW habitat.

In Alternative B once the new stand of trees is established (normally 3-5 years), the seed trees are removed. In Alternative C (MILs 1 and 2) and E (MIL 1) retention of reserve trees is optional. If reserve trees are not retained, the effect will then be almost identical to those described previously for a clearcut.

In those situations where shelterwood and seed-tree methods are allowed, and there is no provision to leave any trees in the harvest area, these stands would be unsuitable as RCW habitat for 20-40 years as described under clearcutting. The potential for habitat fragmentation is also the same as described previously under clearcutting. The long-term cumulative effects are the same as described previously under the clearcutting.

If reserve trees were retained in Alternatives C (MILs 1 and 2) and E (MIL 1), stands that were harvested would retain some RCW suitability. MIL 2 of Alternative E requires its retention of at least 6 trees per acres in seed-tree and shelterwood harvest areas and would therefore retain some RCW suitability. The cumulative effects would be areas of regeneration with scattered relicts providing potential cavity trees across the landscape. See additional discussion under Vegetation for the seed-tree and shelterwood methods on pages 258-262.

Two-aged Silviculture - Irregular Shelterwood

The irregular shelterwood method of cutting for regeneration is very similar to the standard shelterwood described previously. It differs in that the final removal cut may occur later in the rotation or not at all. Implementation of the irregular shelterwood method varies by alternative, MIL, and the species of pine being managed. Therefore, the effects of this regeneration method on the RCW and its habitat will be addressed accordingly.

Direct Effects

Alternative A: This alternative requires the retention of 25-40 square feet of basal area in longleaf pine and 30 square feet in other yellow pine types. The direct effect on the RCW of leaving this many trees would be minimal. Such a stand would still provide substantial amounts of foraging habitat and minimal habitat fragmentation.

Alternative B: The irregular shelterwood method will probably not be used extensively in this alternative. Any effects will be similar to Alternative A, but to a much lesser extent.

Alternative C: Implementation of the irregular shelterwood method varies by MIL in this alternative:

> **MILs 3-5:** 40 square feet of basal area will be left for all forest types. Direct effects would be the same as described above under Alternative A.

Alternative D: This alternative has no planned regeneration of future RCW habitat. The only regeneration allowed is to restore desirable native pine species such as longleaf. Since the irregular shelterwood method is not compatible with this objective, it will probably not be used.

Alternative E: Implementation of the irregular shelterwood method varies by MIL in this alternative:

> **MIL 4:** This MIL calls for the retention of 40 square feet of basal area. Direct effects are as described above for Alternative C, MIL 3-5.
>
> **MIL 3:** This MIL calls for the retention of 25-30 square feet of basal area. Direct effects would be similar to those described above for Alternative A.

Indirect and Cumulative Effects

The long-term effects of leaving 20 to 40 square feet of basal area per acre on the survival, growth, and development of the new age class have not been tested on a large scale. Research has indicated leaving residual trees following the establishment of regeneration, can affect survival, growth, and development of new age classes (Baker and Murphy 1982, Boyer 1993). The survival, growth, and development of the new age class of pine trees depends on the number, size, and basal area, increase or decrease of pine parent trees over time, soil and site conditions, and mortality patterns. The effects of root competition from the parent pine trees and other vegetation in the younger pine trees are greater on drought-prone sites and other sites during severe droughts.

Alternative A: The shelterwood trees are left indefinitely. Retention of this degree of overstory will affect the growth of new trees. It is not certain that these methods can supply a steady flow of RCW habitat in the long-term on many acres, particularly where no parent trees are removed and their growth exceeds mortality for 10-20 or more years. If there is not a staged reduction in the parent trees on many sites, many trees in the younger age class could die or would be severely suppressed (Walker 1995). As little as 27 square feet of residual basal area has been shown to prevent longleaf pine seedlings from developing at a rate adequate to guarantee perpetuation of the stand (Boyer 1993). Thirty square feet of residual basal area may retard the growth of loblolly seedlings up to 50 percent over the first 10 years (Walenberg 1960). It may take 40-50 years to grow loblolly pine foraging-sized trees when this much basal area is retained indefinitely. Fewer foraging and potential cavity trees will be grown in the new age class depending on growth and mortality of the parent trees. Perpetuation of adequately stocked stands to support RCW indefinitely becomes questionable. Stands managed in such a manner may also be more susceptible to windthrow. With a subsequent loss of the larger trees needed by the RCW, these stands could become totally unsuitable as RCW habitat for several years until the new stand reaches adequate size/age. See additional discussion under Vegetation for the irregular shelterwood method on pages 263-269.

Alternative B: The irregular shelterwood method is not likely to be used extensively. Any effect should be similar to Alternative A.

Alternative C:

> **MIL 5:** The 40 square feet of basal area is retained as long as the RCW population remains in MIL 5. During this time the indirect and cumulative effects are similar to those described for Alternative A. However, if the RCW population increases and moves into MIL 4, the basal area could be reduced, increasing the probability the new stand of trees can grow enough to perpetuate the stand. Susceptibility to windthrow and potential loss of the trees suitable as RCW habitat is still a possibility. Those residual trees which do survive will become future cavity trees scattered throughout the new stand.

MILs 3-4: If the RCW population in question is in one of these MILs, there can be a gradual reduction of the leave basal area once regeneration is established down to six trees per acre. Longleaf pine is an exception. As soon as the new stand is established the residual trees can immediately be reduced to six trees per acre. As the RCW population increases and the residual basal area is reduced, the growth of the new stand should increase. In those situations where only six trees per acre must be retained, the stand will be suitable as RCW habitat to a small degree until the new age class reaches foraging size. Susceptibility to windthrow and potential loss of the trees suitable as RCW habitat is still a possibility. Those residual trees which do survive will become future cavity trees scattered throughout the new stand. See additional discussion on leaving six longleaf trees per acre under Vegetation for the seed-tree method with reserves on pages 258-261.

Alternative E:

MIL 4: The 40 square feet of basal area is retained as long as the RCW population remains in MIL 4. The indirect and cumulative effects are the same as those described in Alternative C, MIL 5. In longleaf stands the residual basal area can be reduced to six trees per acre once regeneration is established. Effects are the same as described for longleaf pine, above in Alternative C, MILs 3-4.

MIL 3: Twenty-five to 30 square feet of basal area will be retained as long as the RCW population remains in MIL 3. Effects will be the same as described above in Alternative C, MIL 5. In longleaf stands where the residual basal area will be reduced to six trees per acre when regeneration is established, effects will be the same as described for longleaf in Alternative C, MIL 3-4.

Loblolly and Shortleaf Pine in High Risk Southern Pine Beetle Areas: This management option is only available in Alternative E. An 80-year rotation will be used. Treatment of the stands varies by MIL.

MIL 4: Retain 40 square feet of basal area as long as the RCW population remains in MIL 4. The effects are the same as described in Alternative C, MIL 5.

MIL 1-3: Retain 25-30 square feet of basal area, but not less than 10 reserve trees per acre, indefinitely. The residual trees must be distributed over all acres. Effects will be similar as described above in Alternative C, MIL 5.

Uneven-aged Silviculture - Group Selection

Group selection method of cutting for regeneration involves removal of the trees, usually the oldest or largest trees, in scattered 1/4- to 2-acre patches at relatively short intervals (10 years). This cutting cycle is repeated indefinitely to encourage the continuous establishment of regeneration and maintenance of a balanced uneven-aged stand (Smith 1986; Farrar 1984).

The uneven-aged stands managed using the group selection system would not have potential nesting trees on every acre. For example, on a 1,000-acre area where the objective is to grow loblolly pine trees to a certain size in 100 years, there could be about 400 one-acre groups containing potential cavity trees scattered over the 1,000 acres. Those groups could average about 20 trees per acre. Since the group selection method provides an uneven-aged stand structure with the age classes intimately scattered over the stand, the spatial arrangement of the potential cavity trees would be displayed as 5-9 trees per acre on 1,000 acres instead of 20 trees per acre on 400 acres (Walker 1995).

The group selection method will not be used in Alternative A or D. It can be used in Alternatives B, C, and E. The effects will be similar for Alternatives C and E.

Direct, Indirect, and Cumulative Effects

There will be no direct effects to the RCW from implementing the group selection method in any alternative.

Alternatives C and E: Use of the group selection method would usually eliminate habitat fragmentation associated with even-aged regeneration methods. Group selection method would create 1/4- to 2-acre patches of unsuitable habitat scattered across the stand.

Due to the requirement to maintain basal area between 60 and 75 square feet to sustain regeneration, stands managed with this method will have fewer total trees, foraging and potential nesting, than stands managed with even- aged methods.

Pine midstory is always present and continually developing in balanced uneven-aged stands. Fire needed to control hardwoods would tend to destroy the pine regeneration which has not reached a fire-resistant stage and thus the future supply of cavity and foraging trees (Walker 1995). This is especially true with shortleaf and loblolly pines. Longleaf, which can be burned at an earlier age, is better suited to this method. Midstory control with all pine species will probably require the use of herbicide. Longleaf stands will require fewer and less frequent herbicide applications. Maintenance of the open, park-like habitat preferred by the RCW may be difficult due to expected midstory development and the small groups of each age class intimately scattered over the stand. Such midstory problems will be more common in loblolly and shortleaf stands.

There is also evidence which suggest uneven-aged stands may be more susceptible to damage by high winds due to their uneven canopy (Hooper and McAdie 1995).

Alternative B: Using the group selection method will probably eliminate habitat fragmentation associated with even-aged regeneration methods. However, the maximum diameter equivalent to a 70-80 year rotation may or may not develop potential nesting sized trees. This could adversely affect RCW population growth. See additional discussion under Vegetation for the group selection method on pages 269-271.

Uneven-aged Silviculture - Single-tree Selection

Single-tree selection method of cutting for regeneration involves removal of scattered individual trees (usually the oldest or largest in addition to some trees from all merchantable diameter classes) at relatively short intervals (every 3 to 15 years). This cutting cycle is repeated indefinitely, to encourage the continuous establishment of regeneration and maintenance of a balanced uneven-aged stand (Smith 1986; Farrar 1984). Care must be taken not to reduce genetic quality and diversity by cutting only the best dominant individuals (high grading).

Balanced uneven-aged stands managed using the single-tree selection system to maximize potential cavity trees would average about five to nine potential cavity trees per acre intimately scattered over a stand (Walker 1995).

The single-tree selection method will not be used in Alternative A or D. It can be used in Alternatives B, C, and E.

Direct, Indirect, and Cumulative Effects

There will be no direct effect on the RCW due to implementing single tree selection harvest.

These effects are similar to those described above for group selection, except more pine midstory would be present or developing in the stand usually under high pine shade. This is especially true in loblolly and shortleaf stands.

Longleaf pine can be regenerated with single-tree selection methods but it is not recommended becuase of the species' intolerance of shade and root competition. This intolerance results in significantly slower growth. It could take 70 years or longer to grow foraging size trees under such conditions (Platt et al. 1988) See additional discussion under Vegetation for the single-tree selection method on pages 271-273.

FRAGMENTATION CONTROL

The primary loss and fragmentation of RCW habitat occurred during the settlement of the Southeast, along with the subsequent clearing of the region's old growth pine forest (Jackson 1971, 1978, and Lennartz et al. 1983). The RCW is now relegated to isolated islands of suitable habitat which represent a very small portion of the original range. Many of these islands are National Forests.

The probability of these widely scattered populations once again being connected by corridors of suitable habitat is very remote and certainly beyond the scope of this document. Therefore, the following discussion of methods to limit/eliminate habitat fragmentation refers only to fragmentation of habitat within those National Forests which are home to the RCW.

Direct Effects

There will be no direct effects on RCW of those actions prescribed to prevent habitat fragmentation

Indirect and Cumulative Effects

Indirect and cumulative effects vary by alternative and will be addressed accordingly.

Alternative A: Alternative A lists no specific activities to prevent fragmentation; however, several recommended actions indirectly limit the potential for fragmentation to occur. Limitations on regeneration methods, high leave basal areas in irregular shelterwood harvest, retention of relict trees and longleaf pine inclusions in other regeneration areas, reduced size of regeneration areas, and longer rotations all contribute to a reduced potential for fragmentation.

Habitat Management Areas in Alternative A are 3/4-mile radius circles around all active and inactive clusters. The above actions minimize the potential for fragmentation within the 3/4-mile radius circles. In large, well dispersed RCW populations, these 3/4-mile circle frequently overlap, and the potential for fragmentation of habitat between circles is eliminated, as well.

However, in widely dispersed populations where the 3/4-mile radius circles do not touch or are many miles apart, there is potential for fragmentation to occur. Fragmentation in the areas between 3/4-mile circles may lead to demographic isolation of RCW clusters. As the clusters become more isolated, there may be a collapse of the population because dispersing birds fail to find mates and suitable nesting habitat.

Alternative B: The only fragmentation control criteria in Alternative B is the requirement that the required foraging habitat be contiguous to and continuous with the cluster. This lack of criteria in conjunction with shorter rotations give this alternative the greatest potential to fragment habitat. This alternative therefore could lead to continued population declines, especially in populations which are small and widely dispersed.

Alternatives C and E: These alternatives have the same proposed actions as described above under Alternative A. In addition, the HMAs are relatively large contiguous blocks of suitable habitat. Both alternatives also have limitations on activities which can occur within 1/4-mile of active clusters and/or recruitment stands in small, widely dispersed populations. These limitation are based on documented adverse effects of removing forest cover within 1/4 mile of small widely dispersed RCW populations (Conner and Rudolph 1991a).

HMAs comprised of large contiguous blocks of habitat should greatly reduce or eliminate the potential for demographic isolation of RCW groups. The additional protection provided in the 1/4-mile zones is needed to ensure survival of the very smallest and most vulnerable populations. All these factors combined will contribute to population growth and eventual recovery.

Alternative D: This alternative does not provide for a sustained flow of RCW habitat. There is no assigned rotation. Fragmentation of habitat should not be a problem. However, this alternative does allow regeneration of stands to restore longleaf or other desirable pine species. Limitations on the acres of restoration which can occur each 10-year period should minimize fragmentation effects until all restoration is completed.

SOUTHERN PINE BEETLE HAZARD REDUCTION

All alternatives implement a similar strategy. Thinning is recommended to maintain tree vigor and reduce southern pine beetle risk. The objective is to achieve a minimum spacing of 20-25 feet between trees, but maintain an overstory pine basal area of at least 60 square feet per acre in clusters, replacement, and recruitment stands and not less than 70 square feet in foraging habitat.

Direct, Indirect, and Cumulative Effects

Effects are the same as described previously for thinning. SPB thinnings normally mirror standard thinning guidelines and contribute to the overall health of the forest and its suitability as RCW habitat. Such activities, in the long-term will contribute to population growth and potential recovery.

CLEARING FOR NONTIMBER MANAGEMENT PURPOSES

This activity involves clearing of forested areas for gas/oil exploration and/or development, road construction, power/pipe line rights-of-way, recreation developments, etc. Such activities could occur in all alternatives.

Direct Effects

There is very limited potential of direct effects to the RCW.

Indirect and Cumulative Effects

Such clearings, which are usually permanent, would become unsuitable habitat, thus reducing the capability of an area to support RCW. The total area devoted to such clearings will be such a small percentage of HMAs the long-term effect on RCW capability will be minimal.

Each alternative contains mitigation to limit potential impacts. In situations where mineral rights belong to a party other than the United States, it may difficult or impossible to prevent exploration/development. Active clusters are the most sensitive areas and such clearings shall be excluded if at all possible. Fortunately clusters will occupy a relatively small portion of HMAs, approximately nine percent. Mitigation, such as directional drilling for oil or gas, or limitations on when activities can occur will usually minimize adverse effects to RCW in or in the immediate vicinity of clusters.

Proposed, Endangered, Threatened, and Sensitive Species (Other than RCW)

OVERVIEW

The 11 National Forests occupied by RCW provide habitat for 177 proposed, endangered, threatened, or sensitive (PETS) species. These 178 species include 20 endangered, 11 threatened, and 147 sensitive species, of which 71 are candidates for listing (see Appendix C for complete listing). There are currently no species proposed for listing associated with RCW habitats. However, the 71 candidate species could be proposed for listing anytime in the future. The species included in this analysis are either known to occur or likely to occur in RCW habitats or microhabitats within RCW habitat, or species known not to occur but for which suitable habitat exists. Examples of the latter category include Florida panther, blue-tailed mole skink, and red wolf.

PAST ACTIONS THAT HAVE AFFECTED THE PRESENT CONDITION

In the southeastern United States, virtually all ecosystems have been influenced by man. Historically, longleaf pine dominated between 60 million (Wahlenberg 1946) and 90+ million (Frost 1993) acres. The existing biological diversity resulted from modification of historical fire regimes, forest type conversions, and fragmented habitat conditions primarily caused by settlement patterns and past land use, not necessarily the result of Forest Service land management practices. The distribution and abundance of pine communities is vastly different from that which occurred historically. There are lesser amounts of longleaf and shortleaf pine, and increased amounts of loblolly and slash pine.

Altering natural disturbance regimes can have dramatic effects on ecosystem function and species associations. In the Southeast, recurring fires have been a long-standing evolutionary agent of habitat change to which native species are adapted (Christensen 1977, Landers 1987, Foti and Glenn 1991). Simard and Main (1987) stated the total extent of fire in the southeastern United States has decreased almost 95 percent in the past 50 years. This has impacted the fire-dependent southern yellow pine ecosystems. In areas where emphasis has been on dormant season burning, flatwoods habitats have deteriorated with the proliferation of evergreen species such as gallberry, titi, wax myrtle, and saw palmetto. In loblolly and shortleaf pine habitats, fire suppression and dormant season burning has altered the natural communities with an increasing hardwood midstory and overstory component.

PRESENT CONDITION OF PETS SPECIES

The existing condition of PETS species populations is primarily the result of forest type conversions, habitat fragmentation, and drastic modification of the historical fire regime. Currently, there are 122 plant species and 56 animal species on the regional PETS list that are associated with RCW habitat or microhabitats within preferred RCW habitat. These microhabitats include areas such as seepage bogs, remnant prairies, and rock outcrops.

Not only have individual species been affected, but species associations have been affected. An excellent example is the relationships revolving around the gopher tortoise. The gopher tortoise is listed as threatened in part of its range and is a candidate for listing in the remainder of its range. Associated with gopher tortoise burrows are 13 animal species that are currently listed or are candidates for listing. None of these 13 species or the gopher tortoise are known to have increasing populations.

Fire control and adverse modification of the fire regime in southern pine ecosystems has had tremendous impacts on the herbaceous plant community as evidenced by more than 100 plant species currently on the PETS species list. Many of these species have had decreases in abundance caused by increases in the hardwood and shrub component, the result of fire control and dormant season burning. The increase in vegetative structural diversity has adversely affected some wildlife species including red-cockaded woodpecker, southeastern American kestrel, and Bachman's sparrow.

SCOPE OF THE ANALYSIS

This analysis focuses on those aspects of the proposed action and alternatives which could effect PETS species.

DISCLOSURE OF EFFECTS

Implementing any of the five alternatives could have direct, indirect, or cumulative effects on proposed, endangered, threatened, or sensitive species. The degree of the effects depends on the management activity, intensity of activity, timing of activity, and biological requirements of the species. Before a project is implemented, a risk analysis should be done to determine potential effects on PETS species. The risk analysis could indicate one species more at risk than another, including the RCW. Management activities should be directed at improving conditions for the most at risk species, even at the detriment of other species, including the red-cockaded woodpecker.

This section discloses the expected direct, indirect, and cumulative effects of specific management activities included in the proposed action and alternatives on PETS species. The following activities associated with RCW management may affect other PETS species:

Habitat Management Area Designation

Cavity Restrictors

Prescribed Burning

Midstory Removal/Control

Pine Restoration

Silvicultural Practices

Direct, Indirect, and Cumulative Effects

Within the area being managed for RCW, the above activities are interrelated and are best discussed together as they occur in the individual alternatives.

Alternative A: The area devoted to RCW management will be 3/4-mile radius circles around active and inactive clusters, totaling approximately 1.4 million acres of pine and pine-hardwood forest region-wide. Interspersed with the pine and pine-hardwood forest will be hardwood bottoms and stringers along small stream courses as well as other nonpine forest types. Analysis of a sample of 3/4-mile circles during development of the Interim S&Gs indicated that an average of 50 percent of each circle will be nonpine forest type.

These circles may or may not overlap depending on the density of clusters. A high cluster density will result in relatively large areas of land being managed for RCW. Conversely, widely separated clusters will result in isolated 3/4-mile radius islands of habitat being managed for RCW.

Within these circles prescribed burning and other methods, if necessary, will be used to remove and control midstory vegetation within RCW clusters and to reduce midstory within the pine and pine-hardwood stands occurring in the remainder of the circle.

Other key management activities occurring within these circles are the restoration of longleaf pine on longleaf sites currently occupied by another pine species. Various silvicultural practices will be implemented to regenerate the forest to ensure a uniform flow of suitable RCW habitat through time. Cavity restrictors will be placed on RCW cavities where needed to prevent enlargement of the entrance.

Individual activities that could directly affect PETS species include prescribed burning, pine restoration, and silvicultural practices. The eggs or nestlings of Bachman's sparrow may be destroyed by prescribed burning during the nesting season. Insects that cannot fly or do not burrow into the ground may be burned. More mobile species, such as birds and mammals are seldom killed by prescribed burning.

Plant species will be directly affected by prescribed burning, and may be affected by pine restoration, and silvicultural practices. Prescribed burning will remove the aboveground portion of plants, and may kill some individuals. Any activity that uses heavy equipment has the potential to crush or uproot plants. Endangered or threatened plants are least likely to be adversely affected because they generally have limited distributions and site specific locations are often known. For example, Harper's beauty is known from only three locations, all within the Apalachicola National Forest.

The indirect and cumulative effects of the six listed management activities on RCW habitats are the elimination or reduction of hardwood midstory, an increase in acreage of longleaf pine, well managed stands with pine basal areas generally ranging from 70 to 100 square feet, and a sustained flow of habitat through time. These activities should result in the open, park-like stands of pine or pine-hardwood preferred by the RCW. Midstory elimination is an objective only in RCW clusters, recruitment, and replacement stands or approximately six percent of the area within the 3/4-mile circles. Over the remainder of the circles, representing approximately 30 percent of the pine and pine-hardwood forest on the 11 National Forests with RCW, the objective is midstory reduction using prescribed burning.

The habitat conditions created across the landscape should be beneficial to numerous PETS animals including but not limited to Bachman's sparrow, Florida mouse, Florida burrowing owl, southeastern American ketrel, and gopher tortoise (see Appendix C).

Increases in gopher tortoise densities and distribution should benefit numerous other PETS animals directly associated with tortoise burrows. These species include the eastern indigo snake, black pine snake, northern pine snake, Florida pine snake, Louisiana pine snake, eastern diamondback rattlesnake, Florida gopher frog, Carolina gopher frog, dusky gopher frog, Aphodius tortoise commensal scarab beetle, Copris tortoise commensal scarab beetle, Onthophagus tortoise commensal scarab beetle and two species of tortoise commensal noctuid moths. None of these above listed PETS species are known to currently have a stable or increasing population (USDI Fish and Wildlife Service 1994).

Brennan et al. (1995) compared small mammal use of pine stands managed for RCW with similar pine stands not managed for RCW. Only one species, the white-footed mouse occurred in all stands sampled in both RCW-managed and unmanaged stands, and accounted for 52 percent of total captures. Looking at the data without the white-footed mouse, shows 71 percent of captures occurred in stands managed for RCW. Of the captures occurring in RCW-managed stands, 51 percent were shrews. Seventy eight percent of all shrews captured occurred in stands managed for RCW. Shrews are insectivorous and it could be concluded the abundance of shrews in RCW-managed stands indicate an abundance of insects and RCW management should benefit invertebrate communities. The biggest small mammal prey item in their study was the hispid cotton rat, and it only occurred in stands managed for RCW.

Any species that utilizes small mammals or invertebrates as its prey base should benefit from RCW management. Increased prey availability should benefit numerous PETS species including but not limited to southeastern American kestrel, loggerhead shrike, eastern diamondback rattlesnake, eastern indigo snake, and black, northern, Florida, and Louisiana pine snakes.

Hobbs and Huenneke (1992) stated suppression of fire in ecosystems dominated by fire-adapted species can severely disrupt ecosystem processes, which may have implication for the conservation of native, fire-tolerant species. Simard and Main (1987) stated the total extent of fire in the southeastern United States has decreased about 95 percent in the last 50 years. The alteration of natural fire disturbance regimes and the location of fire control lines in transition zones has affected plant communities as evidenced by more than 100 PETS plant species occurring in RCW habitats. The emphasis on growing season burning, combined with silvicultural practices including thinning and low intensity site preparation, should benefit PETS plant species.

The only PETS species other than the RCW that could potentially be affected by cavity restrictors is the southeastern American kestrel and Sherman's fox squirrel. Only a small percentage of available cavities in a forest are RCW cavities and range wide only a small percentage of RCW cavities would have restrictors. Therefore, the vast majority of cavities would still be available for kestrels and fox squirrels. Any effect should be negligible.

Alternative B: Production of quality RCW habitat and subsequent changes in vegetative composition and structure is emphasized only within RCW clusters, replacement, and recruitment stands. These special areas represent approximately three percent of the total pine and pine-hardwood forest on the 11 National Forests with RCW. The effects of the RCW management activities on PETS species should be the same as for Alternative A, except the management activities will be restricted to much smaller areas. The shorter rotations may affect any PETS species that is sensitive to habitat fragmentation.

Alternatives C-E: These alternatives establish relatively large HMAs (6,150-acre minimum, average size of tentative HMAs is 72,700 acres) which are devoted to RCW management. A total of nearly 2 million acres (approximately 44 percent of the total pine and pine-hardwood forest on the 11 National Forests with RCW) are included in tentative HMAs. Approximately 10 percent of the HMAs are included in RCW clusters, replacement, and recruitment stands where midstory elimination is an objective. The effects will be similar to those described in Alternative A, but will affect a much larger portion of the pine and pine-hardwood forest types on the 11 National Forests. Management will be at a landscape scale.

Wildlife (Other than RCW and PETS)

OVERVIEW

The 11 National Forests occupied by RCW are also home to numerous other species of terrestrial wildlife. Some of the more prominent are game species such as white-tailed deer, wild turkey, black bear, and squirrels (both gray and fox). The total number of nongame species greatly exceeds the number of game species.

PAST ACTIONS THAT HAVE AFFECTED THE PRESENT CONDITION

Based on the cut-over and abused condition of the lands which became the National Forests (Shands 1992) and what is known of the populations of certain game species early in this century, it is possible to visualize the condition of wildlife populations in general at this point in time. Deer and wild turkey populations reached a low ebb in the 1920s and 1930s. These species were extirpated from large portions of their range. These losses were primarily the result of habitat loss and uncontrolled hunting (Trefethan 1961, Halls 1984, Dickson 1992).

Conversely, the clearing of the forest and subsequent agricultural activities in many areas resulted in an increase in numbers of bobwhite quail (Stoddard 1931).

Although historic population data is generally unavailable for nongame species, it can be assumed from what is known about deer, turkey, and quail that species needing mature or old growth forest declined, while those which preferred early successional stages increased.

As the forest grew again on what is now the National Forests, certain management practices such as excluding fire or burning at times of the year other than the naturally occurring fire regime resulted in significant changes in the species and structural composition of the vegetation. These vegetational changes resulted in redistribution of wildlife species on the landscape.

PRESENT CONDITION OF WILDLIFE POPULATIONS AND HABITAT

The National Forests are again in a forested condition. Wildlife management over the past 25-30 years has stressed maximizing habitat diversity through providing a variety of forest age classes scattered over the landscape. This was accomplished primarily with even-aged regeneration methods. This management approach is intended to increase species richness. It was believed this was the most economical way to provide the most good for the most species with the fewest dollars spent (Knopf 1992b).

The restoration of deer (Halls 1984) and wild turkey (Dickson 1992) to their former range are well documented wildlife management success stories. The 11 National Forests occupied by RCW have shared in this success with all supporting viable populations of both species.

Northern bobwhite populations have been declining almost range-wide for three decades. Changes in land use, clean-farming practices, and silvicultural practices which maximize basal area are the most likely causes of habitat loss and subsequent declines. These declines are very perplexing because effective habitat management techniques for bobwhites have been known for over half a century (Brennan 1991).

The condition of other wildlife populations on the National Forest is less well understood. Monitoring of nongame species on National Forests was uncommon prior to the implementation of Forest Plans in the mid-1980s. We know, for example, that neotropical migrant birds are declining regionwide. Species needing unfragmented mature forest and those needing early successional forest are decreasing (Thompson et al. 1992).

These examples illustrate the complexity involved in determining wildlife population trends and how they respond to various management activities. The fact that some late and early successional species are declining, emphasizes this complexity and points out that the problems may be more than simply the availability of late or early succession habitat.

SCOPE OF ANALYSIS

This analysis focuses on those aspects of the proposed action and the alternatives on wildlife species other than the RCW or those species classified as proposed, endangered, threatened, or sensitive (PETS).

DISCLOSURE OF EFFECTS

This section discloses the expected direct, indirect, and cumulative effects of specific management activities included in the proposed action and alternatives on wildlife. The following activities associated with RCW management may affect wildlife:

- Habitat Management Area Designation
- Prescribed Burning
- Midstory Removal/Control
- Pine Restoration
- Silvicultural Practices

Direct, Indirect, and Cumulative Effects

Within the area being managed for RCW the above activities are interrelated and are best discussed together as they occur in the individual alternatives.

Alternative A: The area devoted to RCW management will be 3/4-mile radius circles around active and inactive clusters, totaling approximately 1.4 million acres of pine and pine-hardwood forest regionwide. Interspersed with the pine and pine-hardwood forest will be hardwood bottoms and stringers along small stream courses as well as other nonpine forest types. Analysis of a sample of 3/4-mile circles during development of the Interim S&Gs indicated that an average of 50 percent of each circle will be nonpine forest type.

These circles may or may not overlap depending on the density of clusters. A high cluster density will result in relatively large areas of land being managed for RCW. Conversely, widely separated clusters will result in isolated 3/4-mile radius islands of habitat being managed for RCW.

Within these circles, prescribed burning and other methods, if necessary, will be used to remove and control midstory vegetation within RCW clusters and to reduce midstory within the pine and pine-hardwood stands occurring in the remainder of the circle.

Other key management activities occurring within these circles are the restoration of longleaf pine on longleaf sites currently occupied by another pine species. Various silvicultural practices will be implemented to regenerate the forest to ensure a uniform flow of suitable RCW habitat through time.

The only one of these individual activities likely to directly affect other wildlife species is prescribed burning. The eastern glass lizard is known to have been killed by prescribed burning. The eggs or nestlings of ground or shrub nesting birds could be destroyed. Insects that cannot fly or do not burrow into the ground would likely be burned. The more mobile species, such as birds and mammals, are seldom killed by prescribed burning.

The indirect and cumulative effects of these management activities is the elimination or reduction of hardwood midstory, resulting in the open park like stands of pine or pine-hardwood preferred by the RCW. Midstory elimination is an objective only in RCW clusters, recruitment and replacement stands or approximately six percent of the area within the 3/4-mile circles. Over the remainder of the circles, representing approximately 30 percent of the pine and pine-hardwood forest on the 11 National Forests with RCW, midstory reduction using prescribed burning is the objective.

The elimination or reduction of the shrubby midstory will likely result in the displacement of bird species such as red-eyed vireo and hooded warblers which prefer such vegetation for nest sites. These species would be replaced by birds which prefer open, park-like stands such as Bachman's sparrow and the northern bobwhite (Brennan et al. 1995). Displacement of the shrub species would occur at the stand level. These species likely would still occur within the 3/4-mile circles but in those stands not being intensively managed for RCW.

Some species of hardwood trees and shrubs may be eliminated or greatly reduced through prescribed burning and other midstory control measures. This would be expected to result in a decrease in the availability of mast on which some wildlife species are dependent. Conversely, some mast producing species such as dwarf live oak and runner oak should be enhanced, if present (Williams 1977). Most mast producing species growing in heavy shade, as these midstory trees are, produce very little mast (Burns et al. 1954, Sharp and Sprague 1967, Goodrum et al. 1971). Overstory mast producers, if present, would probably not be affected. Because of the limited mast production capabilities of midstory species and the fact that overstory mast producers will be impacted very little, overall effect on mast dependent species is expected to be minimal.

No wildlife species is likely to be eliminated from the 3/4-mile circles. Instead they would be displaced to the transition zones between the pine ridges and natural hardwood areas or to the hardwood areas themselves, where they likely occurred historically (Landers 1987).

Alternative B: Production of quality RCW habitat and subsequent changes in vegetative composition and structure is emphasized only within RCW clusters, replacement, and recruitment stands. These special areas represent approximately three percent of the total pine and pine-hardwood forest on the 11 National Forests with RCW. The effects of the RCW management activities will be the same as for alternative A within these smaller areas.

Alternatives C-E: These alternatives establish relatively large HMAs (6,150-acre minimum, average size of tentative HMAs is 72,700 acres) which are managed for RCW and associated species. A total of nearly 2 million acres (approximately 44 percent of the total pine and pine-hardwood forest on the 11 National Forests with RCW) are included in tentative HMAs. Approximately 10 percent of the HMAs are included in RCW clusters, replacement, and recruitment stands where midstory elimination is an objective. The effects will be similar to those described in Alternative A, but will affect a larger portion of the pine and pine-hardwood forest types on the 11 National Forests.

Vegetation

OVERVIEW

The RCW is a bird of the southern pine forest. The 11 National Forests in the Southern Region currently occupied by RCW contain a total of about 4.9 million acres of pine and pine/hardwood forest.

The majority of the RCW habitat occurs in two broad forest vegetation regions:

(1) Oak-hickory-pine forests are the most widespread. Many people recognize those as loblolly-shortleaf pine-hardwood forests. They are interspersed throughout the upper, middle, and lower Coastal Plains and are a major component in the Piedmont and Interior Highlands and Appalachian Mountains landscape zones. Those forests contain mixtures of both pine and hardwood species. The pines and many upland hardwoods (especially oak) have evolved with periodic fires.

Loblolly, shortleaf, and to a much lesser extent Virginia pine, predominate. Hardwoods are codominant with pine over much of the area, and significant hardwood mid- and understories are characteristic of these forests except where periodic burning occurs. Most common are species of oak and hickory, along with dogwood, persimmon, sweetgum, elm, redcedar, yellow poplar, black tupelo, and red maple. Common shrubs and vines include American beautyberry, hawthorns, hollies, blueberries, viburnums, greenbriers, blackberry, yellow jessamine, honeysuckle, and grape. Common herbaceous species in open areas include little bluestem, pinehill bluestem, broomsedge bluestem, crabgrass, panicums, and paspalums. Beneath denser canopies, the spike grasses predominate. Common forbs, comprised mainly of legumes and composites, include tickclovers, lespedeza, partridgepea, goldenrod, aster, ragweed, dogfennel, yankee weed, and blackeyed susans (USDA Forest Service 1989a, p. III-3 to 5, 9, 11; 1989b, p. III-10, 13, 14, 17; 1990, p. III-3 to 8, 11).

(2) Southern mixed and sand pine scrub forests border the Atlantic and Gulf coasts from North Carolina to east Texas. These are commonly known as longleaf and longleaf-slash pine forests. They generally occupy the lower and middle Coastal Plain landscape zones. Longleaf also grows in the Piedmont, ridge and valley, and mountain provinces of Alabama and northwest Georgia.

Longleaf and slash pines predominate, but small amounts of loblolly, shortleaf, and Virginia pine do occur in those forests. Sand pine is unique to this grouping and occurs only in Florida and southwest Alabama. This species is not utilized by the RCW.

Other tree species associated with longleaf pine forests include turkey oak, bluejack oak, blackjack oak, myrtle oak, live oak, holly, titi, cabbage palmetto, and southern magnolia. Where fire has been excluded, a heavy understory of volatile evergreen hardwood species, such as saw palmetto, gallberry or titi commonly occurs. Common shrubs and vines include rosemary, yaupon, runner oak, sand post oak, wax myrtle, gallberry, and greenbriers.

Within longleaf pine forests, herbaceous vegetation is divided into two associations. In the western Gulf Coastal Plain, the dominant herbaceous vegetation is bluestem grasses. Most common among the grass species are little bluestem, pinehill bluestem, slender bluestem, broomsedge bluestem, pineywoods dropseed, panicums, and paspalums. In the eastern Gulf Coastal Plain, species of wiregrass are the dominant herbaceous vegetation association with longleaf pine forests. Pineland threeawn, bottlebrush threeawn, and arrowfeather threeawn are the most prevalent wiregrasses. Other common grasses include creeping bluestem, chalky bluestem, broomsedge bluestem, curtis dropseed, lopside indiangrass, panicums, and paspalums.

Forbs common to both associations include tickclover, lespedezia, partridge pea, tephrosia, rhynchosia, asters, eupatoriums goldenrod, deertongue, grassleaf, and swamp sunflower. Other plant species such as bracken fern, cinnamon fern, and prickly pear cactus are also prominent in those forests.

Hardwoods, shrubs, and ground cover most closely associated with longleaf pine can be very different on mesic Coastal Plain sites, xeric sandhill sites, dry clay hills and mountains of Alabama, low wet flatwood sites near the coast, and other distinct sites.

Forests that receive frequent prescribed burns are primarily comprised of herbaceous understories dominated by grasses. The same hardwood tree, shrub and vine species occur in prescribed burned areas as in unburned areas, but those species are generally limited to lower, wetter portions of fire-managed forests (Boyer 1990b, USDA Forest Service 1989a, p. III-4, 6, 8 to 11; 1989b, p. III-10, 13, 14, 17).

PAST ACTIONS THAT HAVE AFFECTED THE PRESENT CONDITION

NOTE: Many of the early writers who described the virgin longleaf forest were foresters and therefore used silvicultural terms to describe what they saw. Several reviewers of the Draft Environmental Impact Statement took issue with this "biased" view. Therefore, Platt et al's. (1988) paper describing the population dynamics of longleaf on the Wade Tract, an old growth longleaf tract in Thomas County, Georgia, has been included in this section to provide a more ecological view point.

The pure longleaf pine forest once occupied perhaps 60 million acres (Wahlenberg 1946) up to 90+ million acres (Frost 1993) throughout the South. In 1985, less than 4 million acres remained (Kelley and Bechtold 1990) and the best estimate for today is less than 3 million acres (Boyer, personal communication).

The longleaf belt covered more than an estimated 100,000 square miles, from southern Virginia to central Florida. It extended west to east Texas and into the Appalachian foothills of Alabama and Georgia. The main belt was 100 to 200 miles wide, averaging 125 miles. Longleaf pines seldom extend more than 150 miles from the coast (Wahlenberg 1946). Loblolly, slash, and shortleaf pines also extend over parts of this area. However, longleaf pine was the dominant tree and generally formed extensive and continuous forests (Schwarz 1907). Longleaf pine naturally occurred on sites ranging from wet, poorly drained clays to deep, coarse, excessively drained sands to dry, rocky mountain ridges (Boyer 1990b).

The old-growth longleaf pine forests were made up mainly of pure even-aged, irregularly open stands. Those stands ranged from a few hundred square feet to several or many acres (Chapman, 1909). Platt et al. (1988) found that most longleaf recruits and juveniles were an average of 11.85 and 11.55 meters from the nearest adult tree, which equates to openings up to a few thousand square feet. Platt also refers to "The presence of large openings ...". However, he does not quantify their size.

Drought, wind, or lightning weakened or damaged the trees so that they became susceptible to insect and fungi attacks. Drought effects were more serious on seedlings and on the smaller trees in crowded stands. Lightning usually strikes the larger, more dominant trees. Wind may break the weaker trees. Bark beetles killed mature longleaf pine trees in small patches to large areas (Ashe 1894). Hurricane damage to virgin longleaf pine forests was most serious in a belt about 50 miles wide near the coast.

In 1906, from 30 to 90 percent of the merchantable timber was blown down in south Mississippi over an area about 50 miles wide and 150 miles long. Tornadoes often make narrow strips, destroying nearly all trees regardless of size. Longleaf seedlings or trees usually die from a complication of causes rather than from a single cause. Death from old age was rare because destructive forces usually occurred first. Mortality became appreciable among trees over 100 years old (Wahlenberg 1946).

Well-stocked old-growth stands contained from 30 to 100 merchantable trees per acre. The larger size classes predominated in the virgin forests. Large areas of the virgin longleaf forest were understocked. The surviving scattered trees were usually remnants of once dense and thrifty stands. Those trees showed evidence of crowding early in life, because of the small flat-top crowns and long boles which were clear of limbs and knots. Also, uprooted trees, burned trunks, stump holes where fire had burned out the original stumps, and an occasional dead snag indicated the previous stocking levels of those stands. Windthrow, lightning, and insect attack appeared to be the major causes of death in those mature and overmature stands (Chapman 1923, Wahlenberg 1946). Chapman (1923) attributed destruction of longleaf pine seedlings to annual burning by the settlers and rooting by hogs as a major reason there were few new stands of longleaf pine established in the past 125 years (since about 1800).

Settlement with changing fire patterns, early naval stores operations, clearing for agricultural purposes, destructive effects of hogs and other livestock on longleaf seedlings, and extensive logging caused most of the changes in the presettlement longleaf forests (Ashe 1895).

Boyer (1990b) reports: "Longleaf pine develops in close association with periodic surface fires. The vegetation associated with longleaf pine reflects the frequency and severity of burning. In the past, frequent fires resulted in open, park-like stands of longleaf with few woody plants and a ground cover dominated by grasses...

With a reduction in fire occurrence, hardwoods and other pines encroach on the longleaf forest. Within the range of slash pine, this species becomes increasingly important, leading to the cover type of longleaf pine-slash pine. Elsewhere, loblolly and shortleaf pines as well as hardwoods gradually replaced longleaf, eventually resulting in the loblolly pine-hardwood type or occasionally loblolly pine-shortleaf pine type. On poor, dry sandhills and mountain ridges, scrub hardwoods invade the understory creating forest cover type longleaf pine-scrub oak and finally southern scrub oak type as the pine disappears."

The following is a very brief history of the southern National Forests. It is intended to illustrate the evolution of management those lands have experienced, before and after becoming National Forests.

The 11 National Forests included within the scope of this analysis were established between 1907 and 1937. With the exception of lands reserved from the public domain, most acquired lands were cut over, burned over, eroded, and understocked. Many thousands of acres of pine lands were understocked or nonstocked because of lack of seed trees and wildfires. In the longleaf belt, hogs destroyed many acres of longleaf seedlings. The mixed shortleaf, loblolly, and hardwood stands had most of the pine removed and the remaining stand contained poor and defective hardwoods. Other lands were abandoned and badly eroded agricultural fields. Regardless of their past history, most were in very poor condition (Shands 1992).

During the period 1911 to 1933, Forest Service management was primarily custodial, but fire protection was the major concern. The purpose of those early management activities was watershed protection, restoration of the productive capability of the land, and establishment of new stands of timber. Roads, trails, and telephone lines were built to improve access for fire control and public recreation. Another important management activity was a modest timber sale program. The chief objective in selling timber was to improve the condition of the forest. Cuttings were designed to remove defective, mature, and overmature trees, which released thrifty young trees or created conditions favorable for restocking. As a result of fire prevention the acquired lands were rapidly stocked with seedlings which reduced erosion and assured a second crop of trees. A variety of cutting practices were used: sanitation and salvage, economic selection (high grading), and cull removal and release cutting.

Those cutting practices are more appropriately called "selective cutting", which do not fit any of the classic silvicultural systems. These practices were used into the 1960s and were sometimes described as cutting the obviously defective and leaving the apparently sound. The goal of this type of cutting was to achieve stand improvement objectives and to set the stage for long-term sustained yield of timber and other renewable forest resources (Young and Mustian 1989).

The Civilian Conservation Corps existed from 1933 to 1942. The Corps changed the southern landscape by planting millions of trees, fighting fires, battling erosion, and building roads, bridges, and recreation areas.

After World War II, because of the improved stocking and growth of both softwood and hardwood stands, management was directed at thinning large areas of pine plantations and extensive second-growth natural stands and the regeneration of second-growth stands approaching maturity. Since second-growth stands were basically even-aged, emphasis was on establishing a balanced system of age classes, classifying site quality for various timber species, and applying prescribed silvicultural systems.

In the late 1940s and 1950s, the Forest Service began rather large scale prescribed burning. Hardwoods in many pine stands were already too large to be controlled by fire.

The Francis Marion National Forest in South Carolina had large areas of second-growth loblolly and longleaf pine reaching the age and condition where management had to consider regeneration cutting. In 1950, the Francis Marion became the first national forest in the country to adopt even-aged management and area regulation. In 1963, even-aged management became a matter of policy and direction for the southern National Forests.

During the shift toward even-aged management, the productive quality of forest sites was determined and the demand for and value of pine timber increased. Cutting prior to Federal management and changes in fire frequency had essentially increased the hardwood component in many pine stands and changed the species composition from pines to primarily hardwoods on other areas. The Forest Service determined many such sites were better suited to growing pines than hardwoods. The new silvicultural prescriptions usually emphasized removal and control of competing hardwood species less suited to such sites. Clearcutting became the primary method of regeneration. Site preparation usually removed and/or controlled the remaining competing woody vegetation. There is also indication intensive mechanical site preparation may alter the species composition of herbaceous plants. Wildlife interests, particularly hunters, recreationists, and even some foresters began criticizing this expansion and intensification of timber management activities.

In the late 1960s and early 1970s, the Southern Region began acting to resolve problems encountered where timber management activities conflicted with wildlife interests. In 1971, the first wildlife/timber coordination guidelines and handbook was developed. Part of the resolution was to leave and/or develop hardwoods in pine stands.

A chain of national events lead to passage of the Multiple Use Sustained Yield Act of 1960, the Wilderness Act of 1964, the National Environmental Policy Act of 1970, the Endangered Species Act of 1973, the Forest and Rangeland Renewable Resources Planning Act of 1974, the Eastern Wilderness Act of 1975, and the National Forest Management Act of 1976 (Young and Mustian 1989).

During the late 1960s and early 1970s, terms like ecosystem management and biodiversity were relatively obscure or were yet to become common concepts. It was not until the late 1970's that the public, as a whole, began to express concerns about how National Forests were being managed.

From the beginning of RCW management in 1975 and through 1990, rotation lengths on National Forests where RCW were found have ranged from 70 to 100 years, depending on the pine species being managed and the method of providing future nesting habitat. Clearcutting remained the primary regeneration method through the mid 1980's, when other methods began to be used more frequently. Since 1988 there has been more than a 70-percent reduction in the acres regenerated by the clearcutting method on the Southern National Forests.

The maximum size of regeneration areas allowed has changed dramatically. In the early 1960s, there were no size limits and regeneration cuts (primarily clearcuts) of several hundred acres were common. Over the next 10 to 15 years, regeneration areas (primarily clearcuts) were reduced in size and scattered over the compartments to provide more edge for early successional wildlife species and to break up large, even-aged stands. Also, a number of pine stands were severely damaged or destroyed primarily by insects and wind. These stands were usually harvested, site prepared, and planted. Maximum size limits in current forest plans are usually 80 acres in the Coastal Plain and Piedmont forests and 40 acres for forests in the other physiographic provinces. The average size of recent regeneration areas, on most forests, is considerably less than the maximum size allowed.

In 1989, an intensive hardwood midstory control program in RCW clusters was initiated. Manual, mechanical, and herbicide treatments were used where the hardwood stems were too large to be top-killed with prescribed burning. Since 1990, when the Interim Standards and Guidelines for the Protection and Management of RCW Habitat within 3/4 Mile of Colony Sites were issued, very few pine stands have been regenerated by any method within the 3/4-mile zones.

PRESENT CONDITIONS OF THE FOREST

The southern National Forests are made up primarily of even-aged stands. This is a result of reforestation efforts which took place soon after their establishment and even-aged silviculture used primarily since the 1960s. About 49 percent of the second-growth pine and pine-hardwood acres have trees remaining in primarily even-aged stands between 50 and 80 years of age. In the past 30 years, about 32 percent of the original second-growth stands have been regenerated. Those third growth stands range between 0 and 30 years of age. Table 3-1 lists the percent pine and pine-hardwood acres in 1992 for each 10-year age class for the National Forests containing RCW. It is assumed the percentage of each age class would be similar in the area designated as HMAs. Each year the percent in each age class will change.

TABLE 3-1
Age class distribution in percent (1992) for all the pine and pine-hardwood forest types on the National Forests which have RCWs.

	Age Classes										
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	100+
%	15.1	9.5	7.6	4.5	4.6	16.1	18.6	14.2	5.8	2.4	1.6

There are thousands of acres occupied by off site pine species. For the purpose of this analysis, off site species is defined as any pine species other than the one expected to be growing on the site based on soil characteristics, moisture regimes, and vegetation. The most commonly replaced pine species has been longleaf because of its relatively slow growth, difficulty in reforesting, and changes in fire regimes. The most frequently occurring off site species are slash and loblolly pines which had the ability to invade former longleaf sites, and because of large scale planting and seeding. Slash pine was also planted extensively outside its natural range.

The majority of the pine acres on some National Forests, outside RCW clusters, has moderate to heavy hardwood midstories. Hardwood midstories developed in many pine stands because: (1) Hardwoods became too large to be controlled with fire before the pines reached a fire resistant stage. (2) Infrequent winter prescribed burns did not control the hardwoods to the understory. (3) Management direction to maintain or develop a 20- to 30 -percent hardwood component allowed hardwoods to reach a fire resistant stage.

SCOPE OF THE ANALYSIS

This analysis focuses on those aspects of the proposed action and the alternatives on the regeneration and growth of the pine forest within RCW HMAs. The effect on other vegetation is discussed to a lesser degree, but is also addressed in the Biodiversity section.

DISCLOSURES OF EFFECTS

This section describes how changes in silvicultural systems associated with recovery of the RCW may affect the regeneration and growth of the pine forests and other vegetation within RCW HMAs.

The following elements of the proposed action and the various alternatives may affect pine regeneration establishment, survival, growth and development and the distribution of other vegetation:

- Midstory control,
- Pine restoration,
- Providing foraging habitat,
- Prescribed burning,
- Thinning,
- Regeneration methods and site preparation methods used.

MIDSTORY CONTROL

Midstory will be controlled within clusters, replacement, and recruitment stands. It will be reduced throughout the remainder of RCW HMAs. (Alternative B will treat only clusters, replacement, and recruitment stands.)

Direct, Indirect and Cumulative Effects

Within clusters, hardwood species will be significantly reduced changing vegetation structure and composition. This will result in an increase in sunlight reaching the forest floor and a subsequent increase in herbaceous vegetation.

Outside clusters, hardwood species because of their density and size may also be reduced significantly. Prescribed fire will normally be used to reduce additional development of the hardwood component. The changes in vegetation structure and composition will usually be less pronounced than in clusters.

PINE RESTORATION

This activity involves the reestablishment of longleaf, shortleaf, or possibly other pine species where there are species that are off site. All alternatives allow or encourage this activity within specific guidelines.

Direct, Indirect and Cumulative Effects

The direct effects of clearcutting are essentially the same in all alternatives. In Alternative B, pine restoration would be accomplished by removing the entire stand in one cutting, except for hardwood inclusions, using the clearcutting method with planting.

The same cutting may occur in Alternatives A, C, D, and E, except where longleaf or shortleaf reserve trees are retained if present. After appropriate site preparation, maximum sunlight will reach the forest floor in the clearcut areas which favors the survival, growth, and development of the shade intolerant pine seedlings.

The reestablishment of pine species most appropriate for the site usually results in more vigorous and healthier stands of trees (Boyce 1961, Pritchett and Fisher 1987). Restored stands with appropriate fire regimes will more closely resemble the ecosystems that occurred historically, both forest type and eventually the shrub and herbaceous understories.

THINNING

Thinnings are made to keep the most desirable trees growing steadily by removing less desirable neighboring trees. Competition from neighbors may cause loss of tree vigor, making individuals more susceptible to death from drought, insects, and disease (Oliver and Larson 1990).

Direct, Indirect and Cumulative Effects

Current pine species would usually remain after thinning. In Alternative B, thinnings usually leave the best formed and most vigorous dominant and codominant trees fairly well distributed and spaced, particularly, after several thinnings. Usually older, suppressed, and poor vigor trees are removed unless they are needed to maintain the main canopy level.

In Alternatives A, C, D, and E, thinnings would usually not remove any of the pine reserve trees (relicts, etc.) which are usually older, poorer vigor trees. Usually the best dominant and codominant trees in the areas between the reserve trees or other age classes are left after thinning. There would usually be fewer pine trees removed in thinnings and fewer dominant and codominant trees remaining than in Alternative B.

In Alternative B, thinnings would usually result in the development of well-stocked stands of well-formed and healthy trees.

In Alternatives A, C, D, and E, the retention of older and poorer vigor trees may result in higher natural mortality as well as poorer growth and development of the new age class. The remaining stand has fewer dominant and codominant trees which are usually smaller and slower growing than in Alternative B. Those stand structures would be clumpier and more irregular in tree diameter, height, and spacing than stands that are essentially even-aged as in Alternative B. An exception is MIL I under Alternative E which is similar to Alternative B.

Repeated thinnings with appropriate fire regimes should provide for stability in the understory vegetation component and structure. Stability of the vegetative component should provide stability in the species associations for a given stand. Any species dependent on dense pine stands could be adversely affected. Continued thinnings through time should ensure reduced risk of southern pine beetle infestation.

The increased sunlight reaching the forest floor would be beneficial to plants with light requirements ranging from filtered sun to partial shade. Individual plants should be more vigorous and produce more fruiting bodies, resulting in growth of individual populations scattered across the landscape. Plant species requiring full shade may be adversely affected and see decreasing vigor and seed production.

FORAGING HABITAT PROVISION

Specific acres are not permanently designated as foraging habitat. The present age class distributions, pine stand stocking levels, and RCW population densities usually determine the acres of suitable foraging habitat available around each cluster.

See pages 54-56 for definition of foraging habitat.

Direct, Indirect, and Cumulative Effects

The direct effects of allocating foraging habitat may affect the establishment, survival, growth, development, and mortality rates of pine trees within a fixed area, for a period of time. Where the number of foraging size trees are at or below required stocking levels, trees could be lost because of: (1) Normal mortality in healthy vigorous stands. (2) Accelerating mortality in mature and off site pine stands. (3) Accelerating mortality in overstocked pine stands with low to moderate SPB risk where thinning is not permitted. (4) Thinnings in pine stands with high SPB risk. (5) Catastrophic events.

Tree vigor would also be reduced in overstocked, mature, and off site pine stands.

Where there are adjacent stands of 20- to 25-year or older pine trees within 1/2 mile of a cluster, these stands could be designated as foraging habitat within the next 10-year period. This could allow the planned regeneration of some stands which are presently designated as foraging habitat.

Some compartments have stands of 1- to 19-year or older pine trees within 1/2 mile of a cluster, which could be designated as foraging habitat within about 10 to 30 years. Those adjacent younger stands would provide increasing numbers of foraging size trees as they grow into the 10-inch diameter class. The acres designated as foraging habitat could be adjusted to allow regeneration in areas previously designated as foraging. As foraging size trees grow older and larger, the number would be continually reduced by either mortality or thinning.

In high density RCW populations where foraging habitat is at or below minimum levels, and there are no young age classes developing, the number of pine trees suitable for foraging would decrease over a period of time.

Providing a continuing supply of foraging habitat within 1/2 mile of clusters requires periodic adjustment in the areas designated as foraging, which allows regeneration cutting to maintain a flow of age/size classes through time.

PRESCRIBED BURNING

Fire is an important ecological factor in the establishment, growth, and development of southern pines. Fire can destroy pine trees as well as insure their survival. Pine species are affected by fire differently at certain stages of development. Each pine species needs a certain fire free period in order to survive, grow, and develop.

See pages 53-54 for additional discussion.

Direct, Indirect, and Cumulative Effects

The direct effects of prescribed burning on pines will vary by species and silvicultural system in each alternative. Virginia pine would not be prescribed burned because it is a thin-barked species which is highly susceptible to fire damage (USDA Forest Service 1989a, p. IV-32).

Growing season fires usually injure or kill more vegetation than dormant season fires. A single fire does not usually kill a high percentage of hardwoods.

Small pine seedlings of any species are vulnerable, even to light fires, soon after germination. Longleaf grass stage seedlings, growing in large openings, are highly resistant to fire once they reach 0.3 inch root collar diameter. If grown under a longleaf pine overstory, grass stage seedlings must reach 0.5 inch root collar diameter before becoming relatively resistant to fire. The slow growth of longleaf seedlings under an overstory extends their vulnerability to fire (Boyer 1974, Boyer and White 1990). Platt et al. (1988) suggests this may be due to the high temperatures produced by the combustion of pine needles under large pines. Longleaf seedlings, once they begin height growth up to two to three feet are also susceptible to fire (Boyer 1990b). Loblolly, slash, and Virginia pine seedlings under five feet in height are usually killed by burning. Shortleaf pine seedlings and saplings top killed by fire may sprout and form new stems.

Most pines in even-aged stands are rarely killed by a light intensity fire, once they are greater than 8 to 12 feet tall or more than 2 to 3 inches in ground line diameter where bark has thickened (Wahlenberg 1960, USDA Forest Service 1989a, p. IV-31, Wade and Lundsford 1989). Loblolly pine saplings up to 2 inches in diameter are killed by medium intensity fires and up to 4 inches in diameter with high intensity fires. Wahlenberg (1960) recommends not burning loblolly pines until they are at least 10 to 15 years old, 15 to 20 feet tall, 3 to 6 inches in diameter with bark thickness of 0.3 to 0.4 inches, and crowns high enough to escape scorching.

Loblolly pine saplings grown in shade have reduced height and diameter growth, thinner bark, and remain susceptible to killing by light intensity fires for a longer period of time (Wahlenberg 1960).

Pine growth responses from burning have been both positive and negative. Early growing season (May) burns improve height growth of longleaf pine seedlings under specific conditions (Maple 1979, Grelen 1983). Southern pines beyond the sapling stage in even-aged stands generally do not suffer damage from low intensity surface fires in the dormant season, if there is little or no crown scorch. However, in young longleaf pine sapling stands on sandy coastal plain soils, it was found biennial dormant or growing season burns of varying fire intensities all reduced young longleaf pine height, diameter, basal area, and volume growth (USDA 1989a, p. IV-37). Boyer (1990a) found that a hot summer burn killed 36 percent (119 of 333) of longleaf pines of one to four inches in diameter and 13 percent (15 of 115) of pines larger than 15.5 inches in diameter at breast height. No longleaf pines in the 5- to 15-inch diameter classes were killed.

Summer burns in stands of mature loblolly pine sometimes result in death due to cambium kill at the groundline where the bark becomes extremely thin and fuel accumulation is high (Boyer 1990a). Loblolly pine trees scorched greater than 60 percent had significant decreases in diameter growth and some decrease in height growth. Upper canopy trees scorched greater than 80 percent had a 12-percent mortality rate in the first year following burning (Tew et al. 1989).

The indirect and cumulative effects of repeated prescribed burning would vary by species, season of burning, frequency, intensity, and silvicultural system.

A long-term burning study was started in 1946 in a 42-year old loblolly pine stand in the lower coastal plain. Pine growth did not increase or decrease because of the burning in this older stand. Over a 30-year period, periodic winter and summer burns increased the number of 0-1 inch diameter hardwood stems significantly and reduced the number of 1-5 inch diameter hardwoods significantly. Most stems less than five inches in diameter were top-killed by burning and produced multiple sprouts. Burning was frequent enough to prevent the sprouts from growing into a larger size class. Annual winter burning produced similar changes in the hardwood diameter distribution. Annual summer burning has nearly eliminated the woody vegetation in the 0-1 inch diameter class and significantly reduced the number of stems in the 1-5 inch diameter class. It took about 8 years of annual summer burning to kill root systems of sweetgum and waxmyrtle and about 20 years to kill root systems of oaks and blackgum. Biennial summer burning was less effective than annual summer burning in killing root systems of all species tested because the root systems had a growing season to recover. Mortality among oak species was less than 50 percent after 13 burns (26 years). Hardwoods greater than 5 inches in diameter were generally unaffected by any of the burning regimes (Langdon 1981, Waldrop et al. 1987, Waldrop and Lloyd 1991).

Differences in fire frequency and season of burn produced four distinct understory plant communities. Understory hardwood abundance was slightly greater in the periodic burn plots and the annual winter plots than in the unburned controls. Only the annual summer burn plots had lower shrub abundance than the control plots. Herbaceous plant abundance increased with increasing fire frequency and was greatest in the annual winter burn plots. The no-burn and periodic burn treatments produced significantly higher woody species richness than either of the annual burn treatments. In contrast, the annual winter burn treatment produced significantly higher herbaceous species richness than the periodic winter and the no-burn treatments. The annual winter burn treatment produced significantly higher understory (woody and herbaceous) species diversity than the annual summer and periodic winter burn treatments, but not higher than for the periodic summer and no-burn treatments (White et al. 1991).

Once even-aged pine stands reach the fire-resistant stage, the effects of prescribed burning on the pine trees depend on fire intensity and season burned. Also, the effects on the hardwoods and other vegetation would depend on the size of hardwoods and shrubs when burning takes place for the first time after stand establishment and any subsequent burning. In even-aged stands, more hardwoods and shrubs could be controlled to the understory with the use of fire than with other regeneration methods because the pines develop faster and reach the fire-resistant stage in a shorter period of time.

Because loblolly, shortleaf, and slash pine require a fire-free period of up to 10 to 15 years, many hardwood sprouts can reach a fire-resistant stage. Longleaf pine requires a fire-free period during the early grass stage and early height growth stage. Although this species is susceptible to fire damage it can sprout from the root collar if top-killed.

Prescribed burning has very limited use (if any) in uneven-aged stands of loblolly and shortleaf pine managed using the single-tree selection or group selection systems. Because of the frequent cutting cycles (every 3 to 15 years), pine seedlings and saplings would usually be present at all times. Most seedlings and smaller, thin bark saplings would be killed (Wahlenberg 1960) even on a 10-year burning cycle. Most hardwoods and shrubs would not be controlled by this burning frequency. Those competing hardwoods and shrubs must be periodically controlled (usually with herbicides) so some of the young pine seedlings and saplings can survive, grow, and develop. In uneven-aged loblolly and shortleaf pine stands this competition control ranges from about every 10 years on moist productive sites (90+ site index) with numerous vigorous hardwoods, to about every 20 years on droughty less productive sites (70 site index or less) with few vigorous hardwoods.

Longleaf grass stage seedlings less than 0.3 inches root collar diameter and seedlings starting height growth up to 2-3 feet would usually be killed by prescribed burning in openings in uneven-aged stands managed using the group selection system. Seedling mortality would be higher near the edges of openings because of the hotter fire due to pine needle litter fuels. The competitive effects of the root systems (about 60 feet) from the large longleaf pine trees surrounding the openings retard the development of the adjacent seedlings and saplings, which makes them more susceptible to fire for a longer period of time.

A 1/3-acre circular opening is entirely under the competition from the adjacent large trees. A two-acre circular opening has about 60 percent of the area under competition. Hardwoods and shrubs would usually not be adequately controlled by burning because of the low intensity fires (lack of pine needle litter). Hardwoods and shrubs would be controlled with other methods when needed (about every 20 years) to allow the establishment and development of longleaf pine seedlings and saplings (Boyer 1974, Farrar and Boyer 1991).

Prescribed burning in two-aged loblolly, shortleaf, and slash pine stands should be delayed until an adequate number of pine saplings and poles reach a fire-resistant stage. This may take 10 or more years longer than in even-aged stands. During this period, many hardwoods will reach a fire-resistant stage. Hardwoods and shrubs would need to be controlled with other methods as needed to allow the survival, growth, and development of pine seedlings and saplings. Once the pines reach a fire-resistant stage, small hardwoods and shrubs could be controlled with periodic prescribed burning.

Most longleaf grass stage seedlings less than 0.5 inches root collar diameter and height growth seedlings up to about two to three feet in height, are at risk by prescribed burning in two-aged stands or even-aged stands using the shelterwood system (while seed trees are retained).

Table 3-2 shows the relationship between root-collar diameter of longleaf grass stage seedlings and fire caused mortality (Boyer 1974). Note that most mortality occurred among seedlings 0.5 inch or less in root-collar diameter.

TABLE 3-2
Longleaf pine seedling loss after a prescribed fire by root-collar diameter.

Root-Collar Diameter (inches)	Seedling Loss (Percent)
0.2	38
.3	49
.4	42
.5	40
.6	22
.7	16
.8	12
.9+	10

The slower growth of seedlings under various levels of overstory extends the period of vulnerability to fire damage. This in turn may delay prescribed burning long enough to allow hardwood shrubs to reach a fire resistant size, necessitating hardwood control measures other than burning, ie manual cutting, herbicide, etc.

The reduction of woody midstory and understory through use of prescribed burning could facilitate the natural regeneration of pine as well as reduce the intensity of site preparation. The long-term implementation of periodic prescribed fires could contribute to the reestablishment and maintenance of native plant communities (ecosystems) once common in the pine forest of the Southeast.

The alteration of natural fire disturbance regimes has affected understory plant communities as evidenced by more than 100 PETS plant species occurring in RCW habitats that should benefit from prescribed burning. The drastic decrease in amount of fire and an emphasis on dormant season burning has resulted in the deterioration of flatwood habitats, with a proliferation of evergreen species, such as gallberry, titi, wax myrtle, and saw palmetto (Landers et al. 1989).

Regularly repeated burns, particularly growing season burns, may eliminate some species of hardwood trees and shrubs and may significantly change vegetation structural diversity. While some species may be eliminated from a stand because of growing season burns, other species such as dwarf live oak, runner oak, chaffseed, and wiregrass may be enhanced or reestablished in a stand, if a seed source is present.

REGENERATION AND SUSTAINING RCW HABITAT

Regeneration methods for southern yellow pines include single-tree selection and group selection for uneven-aged stands; irregular shelterwood for two-aged stands; and shelterwood, seed-tree, and clearcutting for even-aged stands. Regenerating a new age class of trees in a forest involves replacing old trees with new trees of the desired species.

See pages 59-73 for additional discussion.

Stand Density - Managed uneven-aged stands for certain southern yellow pines usually have basal areas ranging from 45 to 75 square feet per acre (does not include trees up to four-inch diameter class) while even-aged stands commonly contain basal areas ranging from 80 to 120 square feet per acre (in fully stocked stands containing six-inch or larger diameter classes).

Stand densities before cutting of uneven-aged stands on average sites should not exceed 75 square feet of basal area per acre and after cutting should not be less than 45 square feet of basal area per acre. Uneven-aged forests grow fewer trees in each age (size) class than do even-aged forests, due to the presence of openings created for regeneration and competition from adjacent larger trees. The frequency of cutting can range from every 3 years up to every 15 years depending on basal area growth rate and basal areas left after each cutting (Farrar 1984, Farrar and Murphy 1989).

Alternatives A,C, and E have extended rotations and limits on the percentage of the HMA which can be in the 0-10 and 0-30 age classes. Because of current age class distributions those criteria would significantly limit the amount of regeneration harvest for the first 10-20 years after implementation. The time period would vary based on the intensity of past forest management activities.

Following is a discussion of the effects of the various regeneration and site preparation methods.

EVEN-AGED SILVICULTURE FOR RCW HABITAT

The three even-aged regeneration methods are clearcutting, seed-tree, and shelterwood. See pages 63-66 for more discussion.

CLEARCUTTING METHOD FOR EVEN-AGED RCW HABITAT

The clearcutting method has been successfully used to regenerate loblolly, shortleaf, longleaf, slash, and Virginia pine in even-aged stands.

See pages 64-65 for additional discussion.

Direct, Indirect, and Cumulative Effects

The effects of clearcutting are the same in all alternatives.

The direct effect of clearcutting is removal of the entire stand in one cutting, except for inclusions or reserve trees. Clearcutting immediately creates an opening in the main tree canopy usually ranging from 10 acres or more in area. Usually there is more site disturbance and vegetation damaged or killed at one time than with other regeneration methods. The amount of sunlight reaching the forest floor is greater with the clearcut method than with any other regeneration method.

The greater the degree of soil disturbance, the greater the likelihood of changes in the herbaceous plant communities. This is particularly true if mechanical site preparation methods are used.

A stand's development pattern is strongly influenced by the site, species present or available for invasion, type of disturbance, and other factors (Oliver and Larson 1990). If preharvest stand conditions include high basal area with dense midstory and understory hardwoods, the herbaceous plant community would likely be composed of shade tolerant species. These plant communities would likely undergo more dramatic changes following harvest that greatly reduces basal area, when compared to plant communities that developed under an open pine stand with little or no hardwood component. Also, the greater the hardwood component in the stand, the more intensive site preparation will have to be to establish a new stand. In general, the higher the number of stems removed per acre and the greater the hardwood component, the more likely there will be changes in herbaceous plant communities.

When the overstory is removed, the growing space is quickly occupied by new plants (tree seedlings, shrubs, annual and perennial herbs) grown from seeds, sprouts, advance regeneration, and other mechanisms (Oliver and Larson, 1990) that compete best under full light conditions. Hardwood and shrub sprouts can out-compete pine seedlings in full sunlight. Those plants must be controlled in some cases to enable an adequate number of pine seedlings to survive, grow, and develop. Normally, appropriate site preparation should be used to control competing vegetation prior to planting. One-year-old pine seedlings are usually planted within one or two years after clearcutting. Planting is used to control pine species, spacing, and number of seedlings per acre. Competing vegetation may be controlled with herbicides one to two times usually in a five-year period during this stand establishment and early growth period (Baker and Balmer 1983, Baker and Langdon 1990). Occasionally, a few stands may need to be replanted because of poor survival.

In a clearcut, planted free to grow pine seedlings will grow faster and generally dominate a site quicker than with any other regeneration method.

The new pine stand develops in the open as an even-aged stand (Smith 1986). This even-aged structure will favor those plant species that grow best under increasing high pine shade as the trees mature. Once the trees (except Virginia pine) are large enough, prescribed burning on a regular basis can control many of the hardwoods and shrubs to the understory. Those stands would usually have one tree canopy level and a very sparse midstory (where controlled) and a wide variety of woody and herb species in the understory.

As each stand grows to maturity, the number of trees decline from either mortality (no catastrophic event) or thinning, very rapidly at first and slower later on, until there may be from 10 to 70 or more trees per acre remaining from hundreds (Smith 1986, Zedaker et al. 1987, Oliver and Larson 1990). Then the regeneration process starts again.

Clearcut stands which are planted, usually grow more trees to larger sizes, in a shorter period of time, than other regeneration methods.

An even-aged stand of one species usually has a canopy top at an uniform height when viewed at the stand level. Even-aged stands, with balanced distribution of age classes, when viewed at the landscape level are irregular in height and the forest is all-aged. Stand boundaries are usually distinct.

The effect of leaving reserve trees with the clearcut method is similar to the effects discussed under the seed-tree method with reserve trees.

SEED-TREE METHOD FOR EVEN-AGED RCW HABITAT

The seed-tree method has been successfully used to regenerate loblolly, shortleaf, and slash pine in even-aged stands (Baker 1987).

See page 65 for additional discussion.

Direct , Indirect, and Cumulative Effects

The effects of the seed-tree method are the same in Alternative B and MIL I of Alternatives C and E. This method was not prescribed in the other alternatives.

The direct effect of using the seed-tree method is the removal of the old stand in one cutting, except for a small number of seed trees left singly or in small groups (Smith 1986) and any inclusions or reserve trees. The seed-tree method provides a continuing cover of some large pine trees for a short period of time. The amount of light reaching the forest floor during the regeneration period is less than with the clearcutting method. For a shorter period, the seed trees and the new seedlings exist as a two-aged stand. The remaining seed trees should be removed within three to five years after adequate reproduction has become well established (Baker and Balmer 1983). Then the new stand develops in the open as an even-aged stand.

When most of the overstory is removed, the growing space is quickly occupied by new plants. Normally, site preparation treatments to control competing vegetation are similar to those used with the clearcutting method. Logging results in some soil scarification which may be adequate on some sites to obtain a seed catch. Seedbed conditions may be improved with prescribed burning or mechanical methods. At this stage, the effect of the seed-tree method on understory vegetation is usually similar to that described for the clearcut method.

Stand establishment takes longer with natural regeneration than with planting. Good seed crops for loblolly, shortleaf, and slash pine usually occur at intervals of three to six years in most parts of their natural range. Additional seedbed preparation and control of competing vegetation may be required before a good seed crop occurs. Root competition from seed trees could seriously affect growth and development of the adjacent new trees and first year survival on droughty sites or during droughts on many sites.

Loblolly, shortleaf, and slash pine stands regenerated by the seed-tree method usually have two logging disturbances within 5 to 10 years which remove trees during the seed cut and the final removal cut. Some damage to the remaining seed trees may occur during logging when the seed cut is made. Some seed trees will usually be lost to wind, ice, lightning or insects. Logging damage to pine seedlings and other vegetation in the seed-tree removal cut is directly related to number and size of trees removed and size of seedlings and other plants.

It normally takes longer to establish a new stand of pine trees with the seed-tree method than with the clearcutting method. Because of this, competing vegetation may need to be controlled 1 to 3 times, usually in a 5- to 10-year period during stand establishment (site preparation) and early development (release).

The new pine stand develops in the open as an even-aged stand similar to stands regenerated using the clearcut method. The new age class of loblolly, shortleaf, and slash pine trees established by the seed-tree method are usually from 2 to 10 or more years behind in establishment, growth, and development as trees planted in clearcuts. This delay in time usually requires additional competition control before the new trees dominate the site.

As each stand grows to maturity, the number of trees decline from either mortality (no catastrophic event) or thinning, very rapidly at first and slower later on, until there may be from 10 to 70 or more trees per acre remaining from hundreds or many thousands. Then the regeneration process starts again.

An even-aged stand of one species usually has a canopy top at a uniform height when viewed at the stand level. Even-aged stands, with balanced age classes, when viewed at the landscape level are irregular in height and the forest is all-aged. Stand boundaries are usually distinct.

The seed-tree method with reserve trees (average 6 trees per acre) leaves some parent pine trees distributed across each stand. There are 3 major ways to leave reserve trees in even-aged stands: (1) Leave the 6 trees systematically scattered over each acre being regenerated, (2) Clump the 6 trees on each acre when the stand is entered to begin the regeneration process, (3) Leave 20 percent of the stand to be regenerated at its present stocking level unless a thinning is needed.

For loblolly, shortleaf, and slash pine, the effects of leaving six trees scattered per acre depends on the their basal area (Table 3-3), growth, mortality, the original basal area retained, how long retained, when any partial removal cuts were made, and the age, size, and vigor of the new age class of trees when the residual parent trees would be reduced to six trees per acre. These effects of leaving reserve trees are discussed in Alternative A under the irregular shelterwood methods in more detail.

For longleaf pine, the indirect and cumulative effect of leaving six parent trees per acre scattered over a stand varies by size of trees and total basal area. Basal area growth of the young longleaf trees would be reduced about 55 percent under 9 square feet of basal area per acre and over 80 percent under 18 square feet, as compared to the stand where the shelterwood seed trees were removed. Adequate longleaf regeneration was not retained (after 35 years) where parent tree density was greater than 27 square feet of basal area per acre (Boyer 1993).

Where the longleaf pine overstory growth and mortality is more or less balanced after a 35-year period, a residual 9 square feet of basal area stand would have about 70 percent fewer trees in the 8-, 9-, and 10-inch and larger diameter classes than in an even-aged stand where the shelterwood seed trees were removed. This amounts to 24 trees per acre in 8- and 9-inch diameter classes and 15 trees per acre in the 10-inch and larger diameter classes. Compared to 85 trees per acre in the 8- and 9-inch diameter classes and 40 trees per acre in the 10-inch and larger diameter classes where the shelterwood trees were removed (Boyer 1993).

The effects of clumping the six trees on each acre allow more of the younger age class of pine trees to be free from competition from adjacent parent trees. Usually younger loblolly, shortleaf, and slash pine will be affected up to about 30 feet around each clump of parent trees. Young longleaf pine are affected up to about 60 feet around each clump of parent trees.

The effects of leaving 20 percent of the stand in 1- to 2-acre or larger clumps allows many more pine trees in the younger age class to be free of the parent tree competition and suppression.

Table 3-3 shows that leaving a fixed number of trees results in a wide range of basal areas per acre. For example, six 17-inch trees contain about 9.5 square feet of basal area while six 24-inch trees contain about 18.8 square feet.

TABLE 3-3
Basal area of 6 trees per acre by diameter class.

DBH (Inches)	BA/Tree (Sq. Ft.)	Number trees per acre	Total BA (Sq. Ft.)
15	1.227	6	7.4
16	1.396	6	8.4
17	1.576	6	9.5
18	1.767	6	10.6
19	1.969	6	11.8
20	2.182	6	13.9
21	2.411	6	14.5
22	2.640	6	15.8
23	2.891	6	17.3
24	3.142	6	18.8
25	3.406	6	20.44
26	3.690	6	22.14
27	3.970	6	23.82
28	4.280	6	25.68
29	4.600	6	27.60
30	4.910	6	29.46

SHELTERWOOD METHOD FOR EVEN-AGED RCW HABITAT

The shelterwood method has been successfully used to regenerate loblolly, shortleaf, longleaf, and slash pine in even-aged stands (Baker 1987).

See page 66 for additional discussion.

Direct, Indirect, and Cumulative Effects

The effects of the shelterwood method are the same in Alternative B and MIL I and MIL 2 of Alternatives C and E. This method was not prescribed in the other alternatives.

The direct effect of using the shelterwood method is the removal of the old stand, except for any inclusions or reserve trees, usually with two cuttings extended over a relatively short portion of the rotation. The shelterwood method normally leaves about two to five times as much basal area per acre in seed trees as does the seed-tree method. The shelterwood method provides a short-term continuing cover of more large trees than the seed-tree method. Amount of light reaching the forest floor is less than with the seed-tree method. The seed trees and the new seedlings exist as a two-aged stand for a short period of time. The remaining seed trees should be removed within three to five years after adequate reproduction has become well established. Then the new stand develops in the open as an even-aged stand.

When part of the overstory is removed, the growing space is quickly occupied by new plants. Since fewer trees are removed in the first cut than with the seed-tree method, logging usually results in less seedbed scarification. Site preparation treatments to prepare seedbed conditions and control competing vegetation are usually similar to ones used with the seed-tree method. At this stage, the effect of the shelterwood method on understory vegetation is usually similar to that described for the other even-aged methods.

Good seed crops for longleaf pine occur on average about once every 4 to 5 years, but may take up to 15 years or more in some parts of the longleaf belt. Platt et al. (1988) reported that cone production in longleaf increased as the age and size of the trees increased. Their data also suggest that year to year variation in cone production declines as the age and size of adult trees increase. Specific ages or sizes are not given. Good seed crops for the other pine species usually occur at intervals of three to six years. Additional seedbed preparation and control of competing vegetation may be required before a good seed crop occurs. Because of the greater number of seed trees left with the shelterwood method, there is more root competition and effect on growth and development of the new trees and first year survival, on droughty sites or during droughts on many sites, than with the seed-tree method. Shelterwood cutting can also result in too much pine reproduction. Where overly dense stands (particularly slash pine) develop they should be precommercially thinned within three to five years with mechanical, manual, or herbicide treatments.

The shelterwood seed cut and the final removal cut result in two logging disturbances which usually occur within a 5- to 20-year period for longleaf pine and within a 5- to 10-year period for loblolly, shortleaf, and slash pine. Because of the larger number of seed trees left, there would usually be more logging damage to those trees than with the seed-tree method. Some seed trees would usually be lost to wind, ice, lightning or insects before the final removal cut. Because more trees are removed, logging damage to pine seedlings and other vegetation in the shelterwood removal cut would usually be greater than with the seed-tree method.

It normally takes longer to establish a new stand of pine trees with the shelterwood method than with the clearcutting method. Because of this, competing vegetation may be controlled with herbicides 1 to 3 times, usually in a 5- to 15-year period during stand establishment (site preparation) and early development (release).

Most longleaf grass stage seedlings less than 0.5 inches root collar diameter and height growth seedlings up to about two to three feet in height are at risk by prescribed burning during the period seed trees are retained.

The new pine stand develops in the open as an even-aged stand, similar to stands regenerated using the seed-tree method except for longleaf pine, which may be from 3 to 20 or more years behind in establishment, growth, and development as trees planted in clearcuts, depending on timing of an adequate seed crop.

An even-aged stand of one species usually has a canopy top at a uniform height when viewed at the stand level. Even-aged stands, with balanced age classes, when viewed at the landscape level are irregular in height and the forest is all-aged. Stand boundaries are usually distinct.

The effects of leaving reserve trees with the shelterwood method is similar to the effects discussed under the seed-tree method with reserve trees.

TWO-AGED SILVICULTURE FOR RCW HABITAT

Two-aged silviculture refers to the irregular shelterwood regeneration method that produces a stand of trees that contains two age classes for a long period of time or for most of the rotation.

See pages 67-68 for additional discussion.

IRREGULAR SHELTERWOOD METHOD FOR TWO-AGED RCW HABITAT

The irregular shelterwood method is an untested regeneration method for loblolly, shortleaf, and slash pine. This method has been tested in longleaf pine over a 35-year period and the results suggest that longleaf pine stands containing two or more age classes will fall far short of fully utilizing the productive capacity of the site (Boyer 1993). In HMAs this may be an acceptable trade off, if the land manager is also willing to accept longer time frames to grow acceptable RCW habitat.

It is not certain that the irregular shelterwood method could supply a steady flow of RCW habitat in the long-term on many acres particularly where the parent trees (overwood) growth exceeds mortality for 10-20 or more years. A staged reduction in the parent trees on these sites would be required to prevent many trees in the younger age class from dying or being severely suppressed.

Direct, Indirect, and Cumulative Effects

The use of the irregular shelterwood method varies by alternative. It would be the primary regeneration method in Alternative A. It would probably be used very little, if at all, in Alternatives B and D. It would be used extensively in Alternatives C and E. The implementation of the irregular shelterwood method varies by MIL and the species of pine being managed.

In most cases, essentially even-aged stands would be changed to two-aged stands by use of the irregular shelterwood method.

Alternative A: This alternative requires the retention of 25 to 40 square feet of basal area per acre in longleaf and slash pine parent trees and a minimum of 30 square feet in loblolly and shortleaf pine parent trees when the seed cut is made. The direct effects of using the irregular shelterwood method (two-aged) during the period it would take to establish a new stand would be essentially the same as for the shelterwood method (even-aged). Shade and root competition would usually be greater where 40 square feet of basal area per acre of parent trees are retained. Normally shelterwood stands containing over 30 square feet of basal area per acre of seed trees would have two removal cuts to prevent excessive damage to the pine seedlings.

Alternative B: The irregular shelterwood method was not prescribed for use in this alternative but could be used. Direct effects during the stand establishment period would be the same as described under the shelterwood method.

Alternative C: Implementation of the irregular shelterwood method is the same for MILs 3, 4, and 5 in this alternative:

MILs 3-5: Forty square feet of basal area per acre of parent trees would be left in longleaf, loblolly, shortleaf, and slash pine stands when the seed cut is made. More parent pine trees would be left per acre in the seed cut than in Alternative A. Direct effects during the stand establishment period would be similar to descriptions in Alternative A.

Alternative D: Not prescribed for use in this alternative.

Alternative E: Implementation of the irregular shelterwood method varies by MIL in this alternative:

MIL 4: Forty square feet of basal area per acre of parent trees would be left in longleaf, loblolly, shortleaf, and slash pine stands when the seed cut is made. Direct effects during the stand establishment period would be essentially the same as described in MILs 3-5 of Alternative C.

MIL 3: This MIL calls for the retention of 25 to 30 square feet of basal area per acre of parent trees when the seed cut is made. Direct effects during the stand establishment period would be essentially the same as described under the shelterwood method.

The indirect and cumulative effects of retaining the parent trees with no planned removal for loblolly, shortleaf, and slash pine has not been tested.

The indirect and cumulative effects of leaving 0, 9, 18, 27, 36, and 45 square feet of basal area per acre for longleaf pine when the seed cut is made has been tested over a 35-year period (Boyer 1993). Longleaf pine is too intolerant of competition for the irregular shelterwood method, if maximum timber production is an objective.

The effects on the new age class of pine and other vegetation depends on the number, size, and basal area increase or decrease of pine parent trees, soil and site conditions, and mortality patterns. The effects of root competition from the parent pine trees and other vegetation on the younger pine trees are greater on droughty sites and other sites during severe droughts.

Some hardwoods and shrubs are favored by those lower light conditions and will overtop some of the young age-class of pines unless controlled.

Alternative A: This alternative requires the retention of 25 to 40 square feet of basal area per acre in longleaf and slash pine parent trees and a minimum of 30 square feet in loblolly and shortleaf pine parent trees when the seed cut is made. There would be no planned removal cutting of the residual parent trees.

The retention of the parent trees provides a continuing cover of some large trees and varying numbers of smaller trees, depending on overstory basal area, for a relatively long period of time.

There are three basic overstory conditions that can occur depending on size (age) of parent trees which could affect the growth and development of the new stand where the parent trees are not removed by logging or a catastrophic event: (1) The basal area per acre in parent trees increases at various rates for many years before stabilizing and then declining. (2) The basal area per acre in parent trees remains constant for many years because growth and mortality balance out before declining. (3) The basal area per acre in parent trees decreases because mortality exceeds growth. The effects on the new age class of pine trees and other vegetation depends on the number, size, and basal area increase or decrease of the pine parent trees, soil and site conditions, and mortality patterns.

Table 3-4 shows the relative measure of full site occupancy where parent trees are retained later in the rotation or not removed at all. A good site with a desired stocking level of 100 square feet of basal area per acre before the irregular shelterwood seed cut is made and 30 square feet of basal area per acre retained as parent trees would have about 30 percent of the area dominated by the parent trees.

Examples of the three overstory conditions that could exist where the parent trees are not removed as shown in Table 3-4 are: (1) There would be about 55 to 86 percent site occupancy by the 60 square feet of basal area per acre of parent trees remaining after 20 years. (2) There would be about 27 to 43 percent site occupancy by the 30 square feet of basal area per acre of parent trees remaining after 20 years. (3) There would be about 18 to 29 percent site occupancy by the 20 square feet of basal area per acre of parent trees remaining after 20 years. The direct and cumulative effects on the growth and development of the new age class would vary significantly because of the pine species involved and the variation in overstory stocking, growth, mortality rates, competition factors, and soil and site conditions.

TABLE 3-4
Percent of area occupied by parent trees of the original stocking levels.

	Parent Trees Retained Basal Area (Square Feet)				
	20	**30**	**40**	**50**	**60**
Original Stocking Levels* Basal Area (Square Feet)	Percent of Area Occupied				
70	29	43	57	71	86
80	25	38	50	62	75
90	22	33	44	56	67
100	20	30	40	50	60
110	18	27	36	45	55

* Represents full site occupancy and initiation of crown or root competition on a range of site and soil conditions.

Under high shade with intermittent sunlight, loblolly pine can survive as overtopped seedlings or saplings for 10 to 20 years, provided severe droughts do not occur and annual height growth exceeds 6 inches (Wahlenberg 1960). Pine seedlings, saplings, and poles that grow in small openings and under high-crowned larger pine trees are oppressed but usually have better crowns than the suppressed and intermediate trees in dense even-aged stands. Those oppressed trees that develop under a high overstory and in small openings prune themselves well and accumulate height but not much diameter (Reynolds 1969). If those oppressed trees are released they can develop into good dominants if they are under 40 years of age and do not have very small crowns (Reynolds 1959, Reynolds 1969).

The effects of root competition, from the parent pine trees and other vegetation, on the younger pine trees are greater on droughty sites and other sites during severe droughts. The high shade and root competition from the loblolly, shortleaf, and slash pine parent trees and the low shade and root competition from the other vegetation could kill many young pine trees while reducing the growth of the survivors from about 30 to 70 or more percent less than trees grown in full sun. The younger even-aged pine trees survive, develop, and grow irregularly under the influence of the parent trees. For many years, this two-aged structure has a very uneven canopy profile similar to the stand structure of an unbalanced uneven-aged stand. A pine midstory would usually develop around most parent trees for 20 to 30 or more years. Pine trees which develop further from the parent tree are larger than trees developed adjacent to the parent tree.

The above discussion would not be applicable to some stands where basal area growth exceeds mortality by about 1 to 2 or more square feet per acre per year over a period of 20 or more years. On some poor sites, 30 to 40 or more square feet of basal area per acre of parent trees could severely retard or prevent the development of an adequate younger stand of vigorous pine trees. The same results could occur on some average to good sites with 50 to 60 or more square feet per acre. If a moisture deficiency occurs, the seedlings growing under high shade die in great numbers with few survivors. After about 30 years under partial shade where the saplings are only 15 to 20 feet in height, they become so badly stunted that recovery is unsatisfactory even when released (Chapman 1945).

Longleaf pine is especially intolerant of competition from any source, especially overtopping trees including parent trees. Longleaf pine seedlings can stay in the grass-stage up to 20 or more years before starting height growth or dying. Basal area growth of the young trees was reduced more than 80 percent during a 35-year period where 18 square feet of basal area per acre was retained and about 55 percent under 9 square feet of basal area per acre as compared to the stand where the shelterwood seed trees were removed. Apparently, an initial parent tree density of about 30 square feet of basal area per acre is near the upper limit under which longleaf pine can be maintained along with surface fires frequent enough to retard hardwood encroachment (Boyer 1993).

Competing vegetation may be controlled with herbicides 1 to 3 times, usually in a 10- to 20-year period, during stand establishment and development.

Prescribed burning in two-aged loblolly, shortleaf, and slash pine stands should be delayed until an adequate number of pine saplings and poles reach a fire resistant stage. This may take 10 to 20 or more years longer than in even-aged stands. During this period, many hardwoods may reach a fire resistant stage (may need to control). Once the pines reach a fire-resistant stage, small susceptible hardwoods and shrubs could be controlled in the understory with periodic prescribed burning.

Most longleaf grass stage seedlings less than 0.5 inches root collar diameter and height growth seedlings up to about two to three feet in height are at risk by prescribed burning where seed trees are retained.

Alternative B: The irregular shelterwood method was not prescribed for use in this alternative but could be used. Indirect and cumulative effects would be similar to discussions in Alternative E.

Alternative C:

MIL 5: Forty square feet of basal area per acre of parent trees would be left in longleaf, loblolly, shortleaf, and slash pine stands when the seed cut is made. There would be no planned removal cutting of the residual parent trees as long as the RCW population remains in this MIL. The indirect and cumulative effects on survival, growth, and development of the young pine trees under such high basal areas would likely be negative because of the increased shade and root competition.

MIL 3-4: Forty square feet of basal area per acre of parent trees would be left in longleaf, loblolly, shortleaf, and slash pine stands when the seed cut is made. Once the pine regeneration becomes established, the parent trees would be reduced in staged removal cuts over a 20-year or longer period, to 6 trees per acre for loblolly, shortleaf, and slash pine. Longleaf pine is an exception. As soon as the new stand becomes established the residual parent trees would be reduced to six trees per acre.

The indirect and cumulative effects resulting from the staged partial removal cuts for loblolly, shortleaf, and slash pine would usually allow more trees in the new age class to survive and increase in size and vigor than would occur with no removal as in MIL 5 of this alternative. The effects resulting from the immediate removal of the residual longleaf parent trees down to six trees per acre would allow many more trees in the new age class to survive and increase in size and vigor than would occur with no removal as in MIL 5 of this alternative. Logging damage to the seedlings and saplings would occur during the removal cut(s). The effects of leaving six residual parent trees per acre is the same as described previously under the seed-tree method.

Alternative E:

MIL 4: Forty square feet of basal area per acre of parent trees would be left in longleaf, loblolly, shortleaf, and slash pine stands when the seed cut is made. The residual parent trees would have no planned removal cuts as long as the RCW population remains in this MIL. During this time the indirect and cumulative effects on survival, growth, and development of the young loblolly, shortleaf, and slash pine trees are similar to those described in MIL 5 of Alternative C. In longleaf stands the residual parent trees would be reduced to six trees per acre once regeneration is established. Indirect and cumulative effects on survival, growth, and development of the young longleaf pine trees would be the same as described in MILs 3-4 of Alternative C.

MIL 3: Twenty-five to 30 square feet of basal area per acre of parent trees would be left in longleaf, loblolly, shortleaf, and slash pine stands when the seed cut is made. The residual parent trees would be retained as long as the RCW population remains in this MIL, except in longleaf pine stands where they would be reduced to six trees per acre once regeneration is established. Indirect and cumulative effects on the young loblolly, shortleaf, and slash pine trees would be similar to the ones described in Alternative A. Indirect and cumulative effects on the survival, growth, and development of the young longleaf pine trees would be the same as in MILs 3-4 of Alternative C.

Loblolly and Shortleaf Pine in High Risk Southern Pine Beetle Areas: This management option is only available in Alternative E. An 80-year rotation will be used. Treatment of the stands varies by MIL:

MIL 4: Forty square feet of basal area per acre of seed trees would be left in loblolly and shortleaf pine stands when the seed cut is made. The residual seed trees would have no planned removal cuts as long as the RCW population remains in this MIL. The residual seed trees left using an 80-year rotation would usually be more vigorous and add basal area growth at a faster rate than would longer rotations. The indirect and cumulative effects on survival, growth, and development of the young pine trees would usually be greater than those described in the section where basal area growth exceeds mortality in Alternative A.

MIL 1-3: Twenty-five to 30 square feet of basal area, but not less than 10 seed trees per acre would be left in loblolly and shortleaf pine stands when the seed cut is made. The residual seed trees would have no planned removal cuts. The residual trees must be distributed over all acres. The residual seed trees left using an 80-year rotation would usually be more vigorous and add basal area growth at a faster rate than would longer rotations. The indirect and cumulative effects on survival, growth, and development of the young pine trees would normally be about the same as discussed above in Alternative A.

Table 3-5 shows that basal areas greater than 25 to 30 square feet of basal area per acre may be needed when the prescription is to leave not less than 10 seed trees per acre. Stands which average 24 inches and larger require a leave basal area of greater than 30 square feet of basal area per acre.

TABLE 3-5
Square feet of basal area per acre varies by diameter class and number of trees.

	Basal Area (Square Feet)			
	25	30	40	50
DBH (Inches)	Trees Per Acre			
15	20	24	33	41
16	18	21	29	36
17	16	19	25	31
18	14	17	23	28
19	13	15	20	25
20	11	14	18	23
21	<u>10</u>	12	17	21
22	9	11	15	19
23	9	10	14	17
24	8	<u>10</u>	13	16
25	7	9	12	15
26	7	8	11	14
27	6	8	<u>10</u>	13
28	6	7	9	12
29	5	7	9	11
30	5	6	8	<u>10</u>

Two-aged stands managed using the irregular shelterwood method usually have a very irregular canopy for a long period of time. Two-aged stands when viewed at the landscape level are irregular in height and the forest is all-aged. Stand boundaries may or may not be distinct depending on growth and development of the younger age class in each stand and the remaining number of parent trees.

UNEVEN-AGED SILVICULTURE FOR RCW HABITAT

Because loblolly, shortleaf, and longleaf pine vary in their intolerance to competition (whether for light or moisture and nutrients), frequent cutting (depends on basal area growth) and hardwood control are required to maintain a balanced uneven-aged stand structure (flow of size classes through time) plus the health and vigor of the stand. To maintain a balanced uneven-aged structure, establishment of regeneration is usually necessary at least once every 10-year period (Baker 1987). The differences between pine species and selection systems will be discussed in the following sections.

GROUP SELECTION METHOD FOR UNEVEN-AGED RCW HABITAT

The group selection method has been successfully used to regenerate loblolly, shortleaf, and longleaf pine in uneven-aged stands (Baker 1987).

See pages 70-71 for additional discussion.

The group selection method will not be used in Alternatives A and D. It will probably not be used in Alternative B. It will probably be used in Alternatives C and E. Where the method is used the effects will be the same in all alternatives.

Direct, Indirect, and Cumulative Effects

Well-stocked even-aged stands (6 inches in diameter and larger) usually contain from about 60 to 120 square feet of basal area per acre.

To begin converting well-stocked even-aged longleaf pine stands to an uneven-aged stand structure using the group selection method, enough trees should be removed in a heavy thinning to allow adequate numbers of longleaf seedlings to become established in parts of the stand. In about 10 years, openings ranging in size from 1/4 to 2 acres would be cut in some parts of the stand where longleaf seedlings are present. Other parts of the stand would be thinned where needed during the same cutting cycle. During the next cutting cycle, either the present group openings would be enlarged where there are longleaf seedlings under the trees to be removed, or new openings would be made only where the trees need to be cut and longleaf seedlings are present. Thinnings would be made where needed in the remainder of the stand.

Longleaf pine seedlings are more affected by root competition of the parent trees and edge effect than the other pine species (Boyer 1963, Boyer 1990b). Usually for about 10 to 20 years after the small group openings are made, many of the longleaf pine seedlings would still be in the grass-stage and would not have started height growth because of the root competition from the adjacent trees around the opening. Most group openings made in longleaf stands would be enlarged in size with succeeding entries to reduce the edge effect on growth and development of this group of trees.

To begin converting well-stocked even-aged loblolly and shortleaf pine stands to an uneven-aged stand structure using the group selection method, group openings ranging in size from 1/4 to 2 acres would be cut in some parts of the stand and the remaining parts of the stand would be thinned where needed. Pine seedling establishment in the openings depends on the same factors discussed under the seed-tree and shelterwood methods.

The more tolerant hardwoods and shrubs out-compete the pine seedlings under these light and moisture conditions except in the center of an opening with a diameter at least twice the height of the surrounding large pine trees. Unless adequately controlled, hardwood and shrub sprouts can out compete pine seedlings from partial to full sunlight (Wahlenberg 1946, 1960, Farrar and Murphy 1989, Farrar and Boyer 1991). Young pine trees overtopped by hardwood and shrub competition would usually need a release within two to five years after establishment in each group (Baker and Balmer 1983).

From about age 4 to 10, height growth of many to most surviving loblolly and shortleaf pine seedlings and saplings would be 20 to 50 percent less than trees grown in large openings (Wahlenberg 1960, Folwells 1965). Also see discussion under Alternative A for the irregular shelterwood method.

Even-aged stands selected for conversion to uneven-aged structures should be young enough so that an adequate number of trees would be expected to live for another 100 years or longer (depends on size trees desired and the age to reach that size). For example, loblolly pine stands which are 50 to 90 years of age and older on some sites would have very few if any of those trees surviving for another 100 years. As a result, stand structures over time could range from essentially even-aged to two-aged or to irregular uneven-aged as the original age class of trees die at various rates. Pine midstory would exist for a long time depending on stand structure.

The number of trees in the original even-aged stand would be reduced each cutting cycle until all have been cut or died. For example, during the 100-year period (time it takes to grow maximum desired size trees), the remaining trees in the original age class would be removed in group openings on about 1/10 of the area and thinned where needed each 10-year cutting cycle. During the first 50-year period, about 1/2 of the stand may have trees remaining from the original even-aged age class.

In many cases, essentially even-aged stand structures could be changed to uneven-aged stand structure over time with the group selection method. Stands which contain irregular patches of mature pine trees and some groups and patches of seedlings and saplings could be changed to a balanced uneven-aged structure sooner than stands with even-aged structure.

Size of opening would have a significant effect on the environmental conditions created and the vegetation that can survive, grow, and develop. The smaller the opening size, the greater the edge effect on survival, growth, and development of smaller pine trees from shade and root competition of adjacent larger pine trees (Baker and Langdon 1990). Trees in the center of the group would usually be larger than trees around the edge. Many of those trees would stay under some level of suppression for a number of years and would respond in varying degrees to release from the older pine trees. Trees in each group would be essentially even-aged. Platt et al. (1988) state that establishment of new individulas in the Wade Tract is almost nonexistent in areas with moderate to high densities of adults and that suppression by large trees even extends well beyond the crowns. To maintain an adequate uneven-aged structure, establishment of regeneration is usually necessary at least once every 10-year period.

Some pine trees and other vegetation would be damaged or killed by logging every cutting cycle (usually every 10 years).

Prescribed burning has very limited use (if any) in uneven-aged stands of loblolly and shortleaf pine managed using the group selection system. Because of the frequent cutting cycles (every 10 years), pine seedlings and saplings would usually be present at all times. Most seedlings and smaller, thin bark saplings would be killed even on a 10-year burning cycle. Most hardwoods and shrubs would not be controlled by this burning frequency. Those competing hardwoods and shrubs must be periodically controlled (usually with herbicides) so that some of the young pine seedlings and saplings can survive, grow, and develop. In uneven-aged loblolly and shortleaf pine stands, this competition control ranges from about every 10 years on moist productive sites (90+ site index) with numerous vigorous hardwoods to about every 20 years on droughty less productive sites (70 site index or less) with few vigorous hardwoods.

The regular use of prescribed fire in uneven-aged (group selection) longleaf pine stands, in which an appropriate grass/forb layer is absent, usually does not adequately control the hardwoods because of the variations in fuels and fire intensity across the stand. This competing vegetation should be controlled (usually with herbicides) about every 20 years.

As the even-aged pine trees in each group grow older the number of trees decline either from mortality or thinning, very rapidly at first and slower later on, until there would only be a few trees (depends on size of group) remaining from hundreds or thousands of seedlings (Smith 1986, Zedaker et al. 1987, Oliver and Larson 1990, Farrar and Boyer 1991).

Where balanced uneven-aged stands are managed using the group selection method, the structure and arrangement of the size (age) classes appear similar whether viewed at the stand level or landscape level (Hunter 1990). The stand viewed from the side shows many groups of pine trees with different height classes. A pine midstory is usually present and/or developing, particularly around some group edges in loblolly and shortleaf pine stands. Stand boundaries tend to disappear in parts of the forest where uneven-aged methods are used.

SINGLE-TREE SELECTION METHOD FOR UNEVEN-AGED RCW HABITAT

The single-tree selection method has been successfully used to regenerate loblolly and shortleaf pine in uneven-aged stands (Baker 1987).

See pages 71-73 for additional discussion.

The single-tree selection method would not be used in Alternatives A and D. It would probably not be used in Alternative B. It will probably be used in Alternatives C and E. Where the method is used the effects would be the same in all alternatives.

Direct, Indirect, and Cumulative Effects

Even-aged stands containing over 100 square feet of basal area per acre should be thinned prior to making the first single-tree selection cut. The first single-tree selection cut in an even-aged stand would reduce the average stand density to about 60 square feet of basal area per acre. A number of scattered small openings would be created by the cutting of a single mature tree or several trees.

Also, the remaining parts of the stand would be thinned where needed to improve the growing space for the adjacent trees. Pine seedling establishment would usually occur in aggregations throughout the stand and would depend on similar conditions as discussed in the group selection method. Those aggregations of pine seedlings would usually be dominated by more high pine shade and root competition than with any other regeneration method.

Depending on basal area growth, those stands should receive another single-tree selection cut in 3 to 15 years to prevent the stand densites (in trees over 3.5 inches in diameter) from exceeding 75 square feet of basal area per acre. Survival, growth, and development of the young pine trees would usually be severely affected when the basal area exceeds 75 square feet per acre.

The effects on survival and growth from high pine shade and root competition, hardwood tree and shrub competition would usually be greater than with the group selection method because of the small openings and high residual basal area per acre. The amount of light reaching the forest floor is the least of any regeneration method (Smith 1986). Most hardwood trees and shrubs, unless controlled, can out compete loblolly and shortleaf pine seedlings under these light and moisture conditions (Wahlenberg 1960, Farrar and Murphy 1989).

Even-aged stands selected for conversion to uneven-aged stand structures using the single-tree selection method should have the same characteristics as discussed for the group selection method. Stands which contain irregular patches of mature pine trees and some groups and patches of seedlings and saplings could be changed to a balanced uneven-aged structure sooner than stands with even-aged structure.

The number of trees in the original even-aged stand would be reduced each cutting cycle until all have been cut or died. This process is similar to the group selection method.

The environmental conditions in the small openings created by the single-tree selection method would be more adverse on young pine tree survival, growth, and development than in the larger openings created by the group selection method. Single-tree size openings may be closed by the expansion of the crowns of adjacent pine trees before the new trees can fill the space. Stand basal area growth determines the cutting cycle between the leave basal area of about 60 square feet per acre and the maximum of about 75 square feet per acre. Cutting cycles are usually more frequent with the single-tree method (depending on stand basal area growth) than with the group selection method in order to provide varying levels of light, moisture, and nutrients to the younger trees. To maintain an adequate uneven-aged structure, establishment of regeneration is usually necessary at least once every 10-year period.

More pine trees and other vegetation would be damaged or killed by logging because of the more frequent cutting cycles.

Prescribed burning has very limited use (if any) in uneven-aged stands of loblolly and shortleaf pine managed using the single-tree selection system. Because of the frequent cutting cycles (usually every 3 to 15 years depending on stand basal area growth), pine seedlings and saplings would be usually be present at all times. Most seedlings and smaller, thin bark saplings would be killed even on a 10-year burning cycle. Most hardwoods and shrubs would not be controlled by this burning frequency. Those competing hardwoods and shrubs must be periodically controlled (usually with herbicides) so that some of the young pine seedlings and saplings can survive, grow, and develop.

In uneven-aged loblolly and shortleaf pine stands, this competition control ranges from about every 10 years on moist productive sites (90+ site index) with numerous vigorous hardwoods to about every 20 years on droughty less productive sites (70 site index or less) with few vigorous hardwoods.

Table 3-6 shows the target stand structure after a cutting cycle entry. Of the total 60 square feet of basal area per acre in trees 4 inches in diameter and larger, 52 square feet of basal area would be contained in 36 trees from 10 to 26 inches in diameter.

TABLE 3-6

A target even-aged stand structure for a loblolly pine stand managed using a maximum tree size of 26 inches in diameter and a leave basal area of 60 square feet per acre (trees over 3.5 inches diameter) and a one-inch Q of 1.1 with a stand basal area growth rate of 3 square feet per acre per year (5-year cutting cycle).

DBH Class (inches)	Basal Area (square feet)	Trees (per acre)
0-3		40-250
4-9	8	34
10-17	22	24
18-26	30	12

As the even-aged trees in each small aggregation grow older the number of trees decline from either mortality or thinning, very rapidly at first and slower later on until there may only be 1 tree remaining from 100 or more seedlings (Farrar 1984, Smith 1986, Zedaker et al. 1987, Oliver and Larson 1990).

Where balanced uneven-aged stands are managed using the single-tree method, the structure and arrangement of the size (age) classes appear similar whether viewed at the stand level or landscape level (Hunter 1990). A pine midstory is usually present and/or developing. Stand boundaries tend to disappear in parts of the forest where uneven-aged methods are used.

Biological Diversity

The following discussion on biological diversity (biodiversity) will be developed and presented in two parts. The first section will present a general overview, past actions that have affected biological diversity, and the present condition of biodiversity. The second section will disclose effects of implementing any of the five alternatives on biodiversity which is a shift in focus from the traditional resource by resource approach to NEPA disclosure, which was described in the previous sections of this chapter.

AN OVERVIEW OF BIOLOGICAL DIVERSITY IN THE CONTEXT OF MANAGING SUSTAINABLE SOUTHERN PINE ECOSYSTEM

The following discussion will present a general overview of biodiversity including definitions, concepts, and general effects of management activities on biodiversity.

Definition

Knopf (1992a) stated the definitions of biological diversity are as varied as the biological resources themselves. Some of these definitions are as follows. Morse et al. (1986) define biological diversity as "The diversity of life." They go on to discuss three levels of biodiversity: genetic, species, and ecosystem diversity. The Keystone Center (1991) in its report on biological diversity on federal lands defined biodiversity as "The variety of life and its processes and includes the variety of living organisms and the genetic differences among them and the communities and ecosystems in which they occur." Landres (1992) stated "Biodiversity can simply and literally be defined as the variety of life on planet earth." Oliver (1992) defined biodiversity as "The variation in life forms, genetic makeup, biological processes, and ecological richness that occur in any specific area." Walker (1992) defines biodiversity as "The integration of biological variability across all scales, from the genetics through species and ecosystems, to landscapes." Smith and Rhodes (1992) state "Biodiversity is often considered synonymous with species diversity." They further state "This view of biodiversity is focused on a single level of biological organization and on one measure of diversity taken within each community. Emphasis also should be placed upon diversity at other levels of organization (population), alternate measures of diversity (genetic variability), and diversity within and among biological systems across the landscape." Hunter (1990) defines biological diversity as "The diversity of life in all its forms and levels of organization: animals, plants, and microorganisms are the three major forms, genes, species, communities, and biomes are among the many levels of organization." The above definitions do vary, however, they do have some commonality including the importance of species, genes, communities or ecosystems, and biological processes.

Franklin et al. (1981) recognized three primary attributes of ecosystems. They are composition, structure, and function and these make up the biodiversity of an area. Noss (1990) expanded on Franklin et al. (1981) by developing a hierarchical approach for monitoring biodiversity. The hierarchy included four levels: regional landscape, community-ecosystem, population-species, and genetic. Noss (1990) combined his four hierarchy levels with the primary ecosystem attributes of Franklin et al. (1981), to develop a matrix of biodiversity indicator variables. Based on the matrix (Noss 1990), concentrating our disclosure of effects primarily on species diversity, habitat diversity, and effect on abundance and distribution, is justified. The matrix lists species diversity, has numerous references to abundance and distribution, and mentions many habitat factors including multipatch landscape types, linkages, fragmentation, patch size, and foliage density and layering, all of which are incorporated in habitat diversity.

Although all aspects of biodiversity are important, our disclosure of effects concentrates primarily on species diversity, habitat diversity, and the effects on abundance and distribution, with emphasis on proposed, endangered, threatened, and sensitive (PETS) species.

We emphasize PETS species because: a) rare species are rare for some reason, b) rare species will likely respond to changing conditions, c) changes in rare species may be more noticeable than changes in common species (RCW population increase versus increase in white-tailed deer), and d) the Forest Service is mandated by law and our policy to conserve PETS species.

Scale

An understanding of the importance of scale, both spatial and temporal, is critical to the management and conservation of biological diversity. Knopf (1992a) stated inquiries into biodiversity must be viewed as ecologically dynamic, including spatial scales ranging from habitats to landscapes and temporal scales that include instantaneous, seasonal, life span or evolutionary perspectives. Murphy (1989) discussed the importance of looking at the proper scale and species and some of the confusion that can arise from analysis at the wrong scale.

Spatial and temporal consideration can affect numerous factors influencing biodiversity, including fragmentation, disturbance, restoration, and preservation. The interrelationships of these factors in time and space ultimately affects species diversity, ecosystem function, and population viability.

Ecosystem Function

The importance of maintaining ecological processes (ecosystem health) has been well documented. Wilcove and Samson (1987) stated conserving biodiversity is maintaining in a healthy state, the variety of life native to a landscape as well as those ecological processes characteristic to that landscape. Walker (1992) stated the best way to minimize species loss is to maintain the integrity of ecosystem function. Lubchenco et al. (1991) stated understanding the role of biodiversity in natural processes and how ecological processes shape patterns of diversity is central to sustainability of all ecological systems. Lubchenco et al. (1991) further state understanding natural processes is important to maintain and/or restore natural ecological systems and viability of species and communities associated with these systems. Saunders et al. (1991) affirm the importance of ecosystem function to individual species when they state, "The question of whether management should be for individual species or whole ecosystems is largely irrelevant because individual species require functioning ecosystems to survive."

One of the objectives in maintaining ecosystem function should be to retain the complexity within the system. The consequences of simplification could be instability, species loss, and further simplification (Pimm 1986). Terborgh 1988, suggests addition or deletion of species can have effects throughout the community. Loss of certain species can affect closely associated species sometimes leading to secondary extinction events (Wilcox and Murphy 1985). An example of this phenomenon could be occurring with the gopher tortoise and the associated species that utilize tortoise burrows. Habitat alteration, changes in natural fire regimes, predation, and habitat fragmentation have led to the gopher tortoise being listed as threatened in parts of its range (U. S. Fish and Wildlife Service, 1990). As tortoise populations declined, local extirpations have occurred and species associated with gopher tortoise burrows have also declined. Landers et al. (1989) listed several species associated with gopher tortoise burrows. Some of these species are of federal concern because of rarity, including the eastern indigo snake (threatened), pine snakes, including black, northern, Florida, and Louisiana [all Category 2 (see glossary for description of Category 1 and 2 species)], gopher frogs including Florida and Carolina (both Category 2), and dusky (Category 1), four species of tortoise commensal scarab bettles, and two species of tortoise commensal noctuid moths (all Category 2) (U. S. Fish and Wildlife Service 1991, 1992). Declines in these species are directly related to habitat alteration and the disruption of species associations which affects ecosystem function.

Addition of exotic species to a system can have devastating results. Probably, the best example in the United States of the impacts of exotic species comes from the Hawaiian Islands. Temple (1985) stated 33 percent of the native Hawaiian avifauna present in 1600 is now extinct; 29 more species are currently listed as threatened or endangered (U. S. Fish and Wildlife Service, 1992). Even with losing 33 percent of the native birds, the existing fauna is arithmetically more diverse today than in the past (Knopf, 1992b).

Habitat fragmentation also has serious effects on ecosystem functions. Two major areas affected by fragmentation are dispersal (moving into new suitable habitat allowing for population expansion) and reproductive success (finding a suitable mate). The U. S. Fish and Wildlife Service (1990) listed fragmentation as one of the causes of population decline in gopher tortoise. With the gopher tortoise, fragmentation affected both dispersal and reproductive success. Conner and Rudolph (1991b) have disclosed the effect of fragmentation on the RCW. Jennersten (1988) discussed the effects of fragmentation on a plant <u>Dianthus deltoides</u>. Jennersten (1988) discovered significantly more seeds produced per flower in unfragmented habitat. Fragmented areas had much lower diversity of flowering plants and anthophilous insects (insects that feed on flowers) than did unfragmented areas. Jennersten (1988) speculated the lower diversity of plants and insects may be due to lower availability of nectar and larval food plants for butterflies as well as nest sites for bumblebees, in the fragmented habitat. Jennersten (1988) concluded the difference in natural seed set between fragmented and unfragmented habitat can be explained by differences in pollinator services.

Some critical points to remember about functioning ecosystems are that ecosystems are constantly in a state of flux, disturbance is natural and necessary for survival of certain species and for maintaining environmental heterogeneity necessary for a wide variety of species, and species composition changes over time with succession (Landres 1992). Managing for functional ecosystems is essential for managing biological diversity (Hansen et al. 1991).

Natural Disturbance

Many forms of disturbance are important components of natural systems (Oliver and Larson 1990). Disturbance is important for creating or maintaining diversity between patches or at the landscape level. Disturbance affects structural and habitat diversity as well as overall species diversity (Hobbs and Huenneke 1992, Landres 1992) A "natural" community does not occur after a long period without large scale disturbance; rather, several communities are "natural" for any site at any point in time (Sprugel 1991). Large scale disturbances resulting in even-aged regeneration are natural.

Some recent examples of landscape scale disturbances include the 1980 explosion and eruption of Mount St. Helen's, the 1988 Greater Yellowstone fires, and the landfall of hurricane Hugo in 1989. Samson (1992) stated "Failure to accept the role of change has and will continue to produce destructive, undesirable results--specifically an increase in biosimplification and loss of biodiversity." Hurricanes have been a major disturbance force in the southeastern coastal plain forests. Hurricanes have had major impacts on red-cockaded woodpeckers (Engstrom and Evans 1990, Hooper et al. 1990).

When discussing the potential impacts of hurricanes on long-term RCW management and recovery, Hooper and McAdie (1995) stated the four most inland of the 15 recovery areas are essentially immune from severe hurricane induced winds. The mean time between category I force winds, (maximum sustained winds of 74 mph) occurring over at least one of the 11 most vulnerable recovery areas, is two years. The mean time between category III force winds, (maximun sustained winds of 111 mph) occurring over at least one of the 11 most vulnerable recovery areas, is 16 years. On average in 100 years, 45 hurricanes are expected to deliver at least category I force winds to 10 of the 11 most vulnerable recovery areas.

Six of these hurricanes are expected to bring very destructive winds of at least category III force to four of the recovery areas. Repeated hits to the same areas could extirpate their RCW populations. It seems certain that at least one recovery area will always be in the process of restoration from hurricane damage. Currently, at least two recovery areas are in that process. Silvicultural practices can be used to reduce the damage caused by hurricanes to RCW habitat.

Of all the natural disturbance forces exerting change on the landscape, only fire has been readily controlled by man. Simard and Main (1987) stated the total extent of fire in the southeastern United States has decreased about 95 percent in the last 50 years. Control of fire and other alterations of natural processes have influenced the structure, function, and composition of most ecosystems (Samson 1992). Hobbs and Huenneke (1992) stated suppression of fire in ecosystems dominated by fire adapted species can severely disrupt ecosystem processes, which may have implication for the conservation of native, fire-tolerant species. The alteration of natural fire disturbance regimes has affected plant communities as evidenced by more than 100 PETS species occurring in RCW habitat that should benefit from prescribed burning. The effect of fire control on ecosystems in North America is well documented (Mutch 1970, Mac Lean et al. 1983, Knight 1987, Cole 1988). In the southeast, recurring fires have been a long-standing evolutionary agent of habitat change to which native species are adapted (Christensen 1977, Landers 1987, Foti and Glenn 1991). In the longleaf pine ecosystem, Landers et al. (1989) stated "Under natural conditions, frequent fires probably kept pine-grasslands and mesic hardwoods so widely separated that competition between the respective wildlife groups was minimal."

Frequency of disturbance has been and will continue to be a major influence on biological diversity. Again, fire is the only natural disturbance where man can significantly influence frequency of occurrence. Natural disturbance regimes help maintain stable communities (Runkle 1991). Man's interference with natural disturbance regimes has affected biological diversity. To conserve biological diversity and achieve a biodiversity more similar to that which existed historically, active management including ecosystem restoration and disturbance regimes that closely resemble natural disturbance frequencies, will be required. Before active management is initiated, an understanding of ecosystem function and species interaction is essential (Walker 1992, Samson and Knopf 1982).

General Effects of Humans

Challinor (1988) pointed out the greatest threat to maintaining biodiversity is human activity. Jenkins (1988) stated biodiversity at all levels--gene pool, species and biotic community are rapidly diminishing because of habitat destruction and other damaging influences resulting from human population growth, pollution, and economic expansion. Ehrlich (1988) stated "The primary cause of the decay of organic diversity is not direct human exploitation or malevolence, but the habitat destruction that inevitably results from the expansion of human populations and human activities." "Most of the planet is dominated neither by pristine ecological communities nor by species on the brink of extinction. Rather, most ecological communities we observe are fragmented, harvested, and polluted--stressed in a variety of ways--by humans and their technology" (Pimm 1986).

In any discussion on biodiversity, it is of critical importance to remember that in most cases we are dealing with man-altered ecosystems. Man's influence on ecosystems has resulted in fragmented habitats, altered natural disturbance regimes, affected ecosystem function, and changed species diversity. Maintaining population viability and conserving biodiversity will require active management and in many cases, ecosystem restoration.

Fragmentation

Fragmentation leads to a decrease in average habitat patch size and an increase in average distance between patches (Wilcox 1980). Wilson (1988) stated accelerating destruction of habitats by human beings has resulted in fragmented landscapes which has led to a reduction in biodiversity. Wilcox and Murphy (1985) stated as development proceeds, natural habitats get more fragmented and extinction rates accelerate. Wilcove et al. (1986) discussed two components of habitat fragmentation, both of which could lead to extinction. These are the reduction in total habitat area which primarily affect population size and thus extinction rates, and redistribution of the remaining areas into disjunct fragments which primarily affect dispersal and immigration rates. Fragmentation can also affect the persistence rates and distribution of various sized animals (Gaines et al. 1992, Morrison et al. 1992, Bennett 1991), and reduce species richness and relative abundance of species (Mac Arthur and Wilson 1967).

Verner (1986) stated most studies of fragmentation have focused on the habitat fragment, not the process of fragmentation. Typically, much of the fragmentation research has focused on remnant woodlots in a landscape of agricultural lands. Forest Service timber management in forest-dominated landscapes does not create isolated patches of forest, but rather a mosaic of habitats ranging from early successional areas to mature forest. Recent research indicates timber harvest in forest-dominated landscapes does not necessarily fragment the forest making it unsuitable for forest interior species, or increase nest predation (Thompson et al. 1992, Thompson 1993, Rudnicky and Hunter 1993, Welsh and Healy 1993).

Habitat Management to Maximize Biodiversity

Yahner (1988) stated "Wildlife managers and land manager have traditionally considered edges as beneficial to wildlife because species diversity generally increases near habitat edges." Wildlife managers have purposely manipulated habitats to create edges and structural vegetative diversity. Leopold (1933) was one of the first to stress the importance of edges in game management. An increase in landscape diversity can increase the number of species coexisting in an area (Johnston 1947, Johnston and Odum 1956, Crawford et al. 1981, Norse et al. 1986, Thompson et al. 1992).

In the early 1970's, there was an increased interest in the conservation of nongame species, primarily birds. To meet the demand for nongame management, many agencies actively managed to enhance species richness because it was felt this was the most economical approach to conserving nongame species; it did the most good for the most species with the fewest dollars (Knopf 1992b). Management was basically to maximize habitat interspersion, thus maximizing species diversity.

Maximizing species diversity is not necessarily a good strategy for conserving biological diversity (Landers et al. 1989, Hobbs and Huenneke 1992, Yahner 1988). Murphy (1989) stated, "The creation of additional habitat edge within continuous habitats can dramatically increase local species diversity, but it fulfills no conservation objective since inevitably, no net increase in regional biodiversity is realized." Murphy (1989) further states, "Arguments focusing purely on species numbers rarely have any bearing on real-world conservation problems." Increased landscape diversity (edge) may result in increased plant and animal diversity locally, but it may adversely affect habitat suitability for some species, particularly habitat specialists or rare species, and may adversely affect regional diversity (Hair 1980, Blake and Karr 1984, Harris 1984, Martin 1992).

A critical point to consider is that habitat management, including harvesting trees, is not automatically going to adversely affect biodiversity. Yahner (1988) and Martin (1992) both state creation of openings and edges in forested landscapes may not be detrimental and in fact, may be beneficial in extensively homogeneous habitats. Thompson et al. (1992) state in extensively forested areas, forest management using rotations of 100 years and clearcutting is compatible with maintaining viable populations of neotropical migratory birds. More than 50% of forest interior migrants in their study occurred at higher densities in clearcut management areas compared to areas without clearcuts, and species dependent on early successional habitat had the most limited distributions. (Clearcut management area does not refer to the clearcut unit itself, but refers to a forested landscape where clearcutting was part of the forest management process). Martin (1992) stated that although creating openings and edges may be beneficial under certain circumstances, caution must be used in attempts to enhance biodiversity so that we do not maximize local diversity at the expense of diversity at a larger scale.

Active Management

Active management is essential to conserving biological diversity and maintaining population viability. Active management includes managing wilderness, mimicking natural disturbance regimes, and ecosystem restoration. Samson (1992) stated, "Only by understanding how nature works (e.g., natural processes) and applying how nature works--active management--will biodiversity be maintained." Wilcove et al. (1986) and Sanders et al. (1991) stated active management is required to prevent or overcome the ecological imbalance created by fragmentation or human activity and to conserve biodiversity. Samson (1992) stated, "Public lands now depend on active management by man for their future and survival."

The first step in managing biodiversity in fragmented systems is to identify the areas needed to maintain diversity (Margules et al. 1988, Saunders et al. 1991). The HMA delineation process is this first step. The HMAs and RCW populations associated with them represent a RCW metapopulation. Gilpin (1988) defined a metapopulation as the collection of relatively isolated populations of a species. Within an individual HMA, there may be metapopulations of other species which are less mobile or have smaller home ranges than RCW's, i.e., insects and plants. Gaines et al. (1992) describe three ways in which metapopulations may go extinct. These include: (1) habitat patches are small, leading to low population density, (2) the number of habitat patches is decreased, thereby increasing population isolation and decreasing dispersal, and (3) the population dynamics in different patches are correlated, leading to a correlation of extinction probabilities. Small population size and isolation produce low effective size, a high level of inbreeding and loss of heterozygosity, and the smaller populations are more vulnerable to extirpation (Shaffer 1981, 1987, Gilpin and Soule' 1986,1988, Goodrum 1987, Lesica and Allendorf 1992).

Gilbert (1980) points out that good reserve design (HMA delineation in this EIS) rarely eliminates the need for active management. Wilcove et al. (1986) state management may include vegetation management to preserve successional stages, the elimination of exotic species, or the culling of nuisance animals. Franklin (1988) and Landres (1992) concur with Wilcove et al. (1986) in that they both state managing native biodiversity requires maintaining an array of successional stages typically occurring in a landscape. Although all successional stages are important, Franklin (1988) suggests managing for the less abundant successional stages and Landres (1992) stated, "merely maintaining the number of species without regard to whether they are native or nonnative is unacceptable when managing for biological diversity."

Murphy (1989) stressed the importance of being selective with regard to which species to manage. He stated some species need our attention, while others can take care of themselves. Cade (1988) stated wildlife managers need to be more innovative in their management approach to conserving biodiversity. An innovative approach has been described by Hutto et al. (1987) and Scott et al. (1988) where they point out saving groups of species in self-maintaining ecosystems may be a cost-effective supplement to endangered species recovery.

Active Management - Wilderness

Wildernesses can have an important role in conserving biological diversity, but they are not the key to conservation of resources (Salwasser 1991). Noss (1991) states set-asides (wildernesses, National parks, botanical areas, etc.) will not fulfill all our conservation objectives; they are inadequate in size and number to maintain biodiversity. Noss (1991) does state, "Nature if given a chance--can still manage land better than we can." This strategy is not valid in the United States today, because of human settlement.

A "let nature take its course" philosophy may be appropriate for large western wilderness areas. However, fire suppression outside of wilderness has affected fuel loads, fire frequency, fire intensity, and ecosystem function within wilderness areas. Many ecologists now realize the need for active management in wilderness to conserve biodiversity and maintain ecosystem function (Stone 1965, Ghiselin 1974, Parsons 1977, Jackson et al. 1986, Samson 1992). Jackson et al. (1986) stress the importance of fire in the southern pine forests and the need for prescribed fire in wilderness to manage for RCW. Although not specifically addressing wilderness, Jordan (1988) identified some problems with a preservation strategy to conserve biodiversity. He stated, "by itself preservation is not an adequate strategy for conserving diversity. At best, preservation can only hold on to what already exists. Critical as it may be as part of such a strategy, preservation has serious defects. Basically, it is a one-way strategy that offers no way of responding to change or recouping losses" (Jordan 1988). Active management in wilderness is essential to conserving biological diversity.

Active Management - Mimicking Natural Disturbance

The importance of natural disturbances on biological diversity have been discussed previously. Hobbs and Huenneke (1992) stated to preserve biotic diversity and functioning natural ecosystems, managers must consider disturbance processes. The continued existence of particular species or communities often requires disturbance of some type that must be integrated with management plans. Managers need to take an active role in designing the disturbance regime, tailoring it to the landscape, the biotic community, and their specific conservation goals. Diversity of native species at the landscape level will be greatest when disturbance occurs at its historical frequency and in the historical pattern (Hobbs and Huenneke 1992). Active management in the Southeast must address the need for a more natural disturbance regime in the management and conservation of biodiversity. Part of the disturbance regime should be growing season prescribed burns on a three to five year cycle.

Active Management - Forest Regeneration

The effects of regeneration on biological diversity would vary with regeneration method and intensity of site preparation. Any silvicultural practice may be temporarily beneficial to certain species while detrimental to others (Perkins 1974, Nobel et al. 1980, Crawford et al. 1981).

When considering wildlife management, regeneration methods that allow sunlight to reach the forest floor (even-aged methods) would increase the production of forage, fruit, and seed (Blair 1960, 1969, Grelen and Enghardt 1973, Halls 1973a, Halls 1973b, Blair and Enghardt 1976, Walters 1981, Hurst and Warren 1982). Murphy and Crawford (1970) stated production of deer and turkey foods were low in most forest types managed under uneven-aged systems because of dense overstories. Goodrum (1969) recommended an even-aged management system on long rotations for deer management in the southeast. McGinnes (1969) also recommended even-aged systems with harvest units less than 50 acres.

Regeneration methods have varying effects on avian species. Habitat manipulations that lead to vegetative complexity generally increase bird densities and bird species diversity (Dickson and Segelquist 1979, Dickson et al. 1984, Harlow and Van Lear 1987). Some of the factors increasing vegetation complexity thereby increasing avian species diversity include vegetative life-form (Pitelka 1941), foliage height diversity (MacArthur and MacArthur 1961, Willson 1974, Knoodsma 1984) and plant species diversity (Karr 1968, Tomoff 1974).

In east Texas, Conner et al. (1983) determined habitat characteristics for numerous birds species. They determined clearcuts provided excellent habitat for early successional species such as white-eyed vireo, yellow-breasted chat, prairie warbler, northern cardinal, and indigo bunting. Pine warbler, Carolina chickadee, and brown-headed nuthatch were associated with mature pine forest. Red-eyed vireo, black-and-white warbler, and tufted titmouse were associated with mature forest with some deciduous canopy. Conditions for the mature forest birds could probably be met with irregular shelterwood or uneven-aged regeneration methods. Crawford et al. (1981) determined songbird responses to different silvicultural practices. They stated bird succession following substantial stand disturbance (clearcut) would generally flow from open-canopy-obligatory species like yellow-breasted chat and prairie warbler to closed-canopy-obligatory species like ovenbird and American redstart. Wood and Niles (1978) studied the effects of shelterwood regeneration methods on birds. They determined there should be minimal impact to bird populations and the degree of impact depends upon the amount of residual overstory left standing and the length of time before residuals were removed.

Vegetation characteristics also affect seasonality of use. In Florida, Repenning and Labisky (1985) determined one year old clearcuts had higher wintering bird densities than any other stand ages analyzed. They attributed the high densities to abundant seed production from the grasses and forbs. However, these same one year old stands had the lowest breeding bird diversity and density. Mature longleaf pine stands had the highest breeding bird diversity and density. Dickson and Segelquist (1977) found winter bird densities in east Texas were highest in the youngest stands surveyed. In a separate study, they found breeding bird densities in Texas were associated with foliage height diversity, not necessarily age related (Dickson and Segelquist 1979).

The responses of wintering birds to harvesting in more northern latitudes compared to coastal plain areas shows opposite effects. Winter bird diversity and density were lowest in recently harvested areas (Conner et al. 1979, Yahner 1986). Dickson (1978) pointed out two reasons why avian diversity and density may be greater in southern latitudes during winter. These were that both permanent residents and large numbers of wintering species were present and that the milder climate provided for a greater abundance of winter food resources. Based on this, diversity of habitats on southern National Forests and adjacent private and corporate lands may be critical to overwintering birds and neo-tropical migrants going to and from their breeding grounds.

Intensity of site preparation for regeneration of a stand can have tremendous effects. Generally speaking, low intensity site preparation techniques (such as prescribed fire) are more beneficial to most plant and animal species than intensive, ground disturbing site preparation techniques (Marion and Harris 1981). Amphibian species may be indirectly affected if site preparation affects the hydrology of their breeding pools. Intensive site preparation favors growth and development of slash pine, at the expense of understory wildlife habitat (White et al. 1975).

Site preparation accomplished with prescribed burning and areas harvested but receiving no site preparation treatment consistently produced more fruits and soft mast than areas treated with soil disturbing site preparation techniques (Stransky and Richardson 1977, Stransky and Halls 1980, Stransky and Roese 1984). Site preparation burns also resulted in the highest nutrient contents in available browse (Stransky and Halls 1976). Forage production is also greatly influenced by timber harvest and site preparation. Stransky and Halls (1981) determined after one growing season, sites prepared with prescribed fire produced more forage than sites prepared by other techniques.

After five growing seasons, forage production from all treatments decreased, but high intensity site preparation areas produced more forage than burned areas. Increased fruit and forage production should increase the small mammal prey base, benefiting any species that use small mammals as food items.

Site preparation techniques can affect bird species diversity. Harris et al. (1974) determined avian species diversity is greater in low intensity site prepared areas and the number of individuals was nearly seven times greater for low intensity areas when compared to high intensity site prepared areas. Meyers and Johnson (1978) stated intensive ground disturbing site preparation and planting done in the fall and winter will eliminate all breeding birds, with the possible exception of killdeer. However, if low intensity site preparation is done and some shrubs and logging debris is left, breeding bird populations will be considerably higher.

Site preparation could have direct effects on wildlife species. Ground and shrub nesting species and those species that utilize subterranean habitats may be directly affected by intensive site preparation. Subterranean PETS species that could be affected include Florida burrowing owl, gopher tortoise, eastern indigo snake, eastern diamondback rattlesnake, three species of tortoise commensal scarab beetle, two species of tortoise commensal noctuid moth, three sub-species of gopher frogs, and four sub-species of pine snakes.

Regeneration will affect plant communities differently depending on pre-harvest stand conditions and intensity of site preparation. If pre-harvest stand conditions include high basal area with dense midstory and understory hardwoods, the herbaceous plant community would likely be composed of shade tolerant species. These plant communities would likely undergo more dramatic changes following harvest that greatly reduces basal area when compared to plant communities that developed under an open pine stand with little or no hardwood component. Also, the greater the hardwood component in the stand, the more intensive site preparation will have to be to establish a new stand of pine trees. In general, the higher the number of stems removed per acre and the greater the hardwood component, the more likely there will be changes in herbaceous plant communities.

Active Management - Ecosystem Restoration

Cairns (1988) speculated much of the planet is occupied by partially or badly damaged ecosystems and restoring them is probably the best way of increasing diversity. Jordan (1988) stated, "Numerous species are already on the brink of extinction and their habitats have been reduced to a remnant or perhaps eliminated completely, so that their only hope for long-term survival is the recreation of their habitat by human beings."

Damaged ecosystems can be changed from ecological liabilities to assets that are useful in both increasing diversity and protecting natural systems (Cairns 1988). Ecosystem restoration must be part of a strategy to manage for sustainable ecosystems and conserve biological diversity (Lubchenco et al. 1991). Ideally, all ecosystems should be restored to their original condition. However, there are certain difficulties that may preclude this including lack of detailed knowledge about the original condition, lack of technology to restore the damaged system, and no satisfactory source of organisms to recolonize the area (Cairns 1986, 1988, Challinor 1988). Although Cairns (1988) implied increasing diversity is an objective of ecosystem restoration, this objective may not be desirable.

The goal of ecosystem restoration should be to restore natural ecosystem components and native historical diversity in an ecologically sound manner. This may indeed result in a decrease in overall species diversity.

Once an ecosystem is restored, natural disturbance regimes should be incorporated into management plans (Samson 1992). Jordan (1988) and Hobbs and Huenneke (1992) warn of the possible spread of exotic species, particularly plants, following site disturbance. Care must be taken during restoration efforts to prevent the inadvertent spread of exotics.

PAST ACTIONS THAT HAVE AFFECTED THE PRESENT CONDITION

The past actions described previously in the section on Vegetation give the reader a good idea of how the diversity of the southern National Forest has been affected. The clearing, farming, grazing, burning, and cutting that took place prior to Forest Service acquisition has so changed the character of the forest that only a few remaining areas even resemble the forest viewed by the first European settlers.

Historically, longleaf pine dominated between 60 million (Wahlenberg 1946) and 90+ million (Frost 1993) acres. Today less than 4 million acres (about 5 percent) of the original longleaf type remain as second growth stands of which only 1-2 percent of the original is publicly held (Landers et al. 1989). Prior to the 1860s, much of the Piedmont physiographic region was cleared and put into crops, primarily cotton. These areas remained under cultivation until the early 1900's.

From the 1890s to 1920s, there was a timber boom in the Southeast. The peak year for lumber production was 1909 when 16 billion feet of lumber was produced (White 1984). Young and Mustian (1989) stated some of the larger companies were cutting as much as 1 million board feet per day and logging during this period left most of the original forests from the Atlantic Ocean to the Great Plains cut over.

Altering natural disturbance regimes has affected ecosystem function and species associations. In the Southeast, recurring fires have been a long-standing evolutionary agent of habitat change to which native species are adapted (Christensen 1977, Landers 1987, Foti and Glenn 1991). The Southeast has one of the highest electrical storm frequencies in the world (Jackson et al. 1986). Landers et al. (1989) stated there was about a 93 percent probability of a lightning ignition between May and August.

This probability of naturally occurring growing season fires can be contrasted with the current burning regime which rarely has a fire between May and August. Simard and Main (1987) stated the total extent of fire in the southeastern United States has decreased almost 95 percent in the past 50 years. The U. S. Fish and Wildlife Service (1990) stated the change in fire frequency and timing may be the single most important factor influencing change in the original xeric communities.

Landers et al. (1989) documented the key role of fire in maintaining the longleaf pine community of the Southeast. They stated, "Under natural conditions, frequent fires probably kept pine-grasslands and mesic hardwoods so widely separated that competition between the respective wildlife groups was minimal." In areas where emphasis has been on dormant season burning, flatwoods habitats have deteriorated with the proliferation of evergreen species such as gallberry, titi, wax myrtle, and saw palmetto.

PRESENT CONDITION OF BIOLOGICAL DIVERSITY

National Forest System lands comprise slightly more than 5 percent of the commercial forest lands in the South (Young and Mustian 1989). As a result of current land ownership patterns and use, the National Forests are isolated from each other. It is doubtful that sufficient habitat linkages will ever exist to overcome this fragmentation. In addition, there are private inholdings within National Forest boundaries, further adding to the potential for fragmentation.

The existing biodiversity on the National Forests is primarily the result of past agricultural uses, forest type conversions, efforts to increase hardwood component in pine stands, habitat fragmentation, and modification of the historical fire regime. The National Forests are again forested, but fire control and modification of the natural fire regime has resulted in changes in plant communities. Increases in the hardwood and shrub component, the result of fire control and infrequent dormant season burning, have affected the distribution and abundance of many animals. Many species now occur in places where the probably did not occur historically. Conversely other species are extirpated from where they had occurred historically

Currently, more than 100 plant species and more than 50 animal species on the regional PETS species list are associated with RCW habitat or microhabitats within preferred RCW habitat. Many of these species, especially plants, are in these special classifications due in part to changes in the fire regime, most importantly changes in fire frequency and season of burn.

Not only have individual species been affected, but species associations have been affected. An excellent example is the relationships revolving around the gopher tortoise. The gopher tortoise is listed as threatened in part of its range, and is a candidate for listing in the remainder of its range. Associated with gopher tortoise burrows are 15 animal species that are currently listed or are candidates for listing. None of these 15 species, or the gopher tortoise, are known to have increasing populations.

SCOPE OF ANALYSIS

This analysis focuses on the effects of the proposed action and the various alternatives on biological diversity. The following section discloses the expected direct, indirect, and cumulative effects the proposed action and alternatives should have on biodiversity, if implemented.

DISCLOSURE OF EFFECTS

This section will disclose the environmental consequences of implementing any of the five alternatives on biological diversity. Temporal scale concerns will be disclosed as direct, indirect, and cumulative effects. Spatial concerns will be addressed at the stand and landscape level.

It is imperative to disclose the differences in potential effects between stand and landscape levels. At the stand level, an activity could have dramatic effects on plant and animal communities. For example, the harvest of a mature stand of trees could eliminate many species from the stand including all canopy nesting birds. However, at the landscape scale, the same activity could be ecologically insignificant, resulting only in displacement of individuals and minor changes in abundance and distribution, so that no species would be lost at the landscape level.

Implementing any of the five alternatives will have direct, indirect, or cumulative effects on biodiversity. The degree of effect is dependent on the management activity, intensity of activity, and timing of activity. When managing for the conservation of biological diversity, emphasis must be on proposed, endangered, threatened, and sensitive (PETS) species; those species most at risk from a viability standpoint (USDA 1983, USDA Forest Service 1991). Even among PETS species, management should emphasize the most at risk species.

HABITAT MANAGEMENT AREA DESIGNATION

Margules et al. (1988) and Sanders et al. (1991), when discussing managing for biodiversity in an already fragmented system state, the first step in management must be the determination of the minimum subset of existing remnants required to represent the diversity of a given area. The HMA delineation process is this first step.

Habitat Management Area designation involves the delineation of an area that represents the desired future demographic configuration of an RCW population. It is a strategy for management at a landscape scale. The intent is to manage an area large enough to avoid or overcome the adverse effects of fragmentation and to reduce the risks involved with small populations and environmental stochasticity (see Mac Arthur and Wilson 1967, Wilcox 1980, Shaffer 1981, 1987, Wilcox and Murphy 1985, Wilcove et al. 1986, Pimm 1986, Jennersten 1988, Goodman 1987, U. S. Fish and Wildlife Service 1990, Gilpin and Soule' 1986, Lesica and Allendorf 1992, Gaines et al. 1992, Saunders et al. 1991, and Conner and Rudolph 1991a).

Habitat Management Areas are not designated in Alternative B. HMAs are landscape level strategies; therefore, there should not be stand level effects from HMA designation.

Landscape Level

Direct Effects

There would be no direct effects on biodiversity from designating HMAs in Alternatives A, C, D, and E or from not designating HMAs in Alternative B because designation is an administrative task consisting of drawing a line on a map.

Indirect Effects

Alternative A: Habitat Management Areas would be 3/4-mile radius circles around active and inactive clusters. In large, dense populations with overlapping circles, adverse effects on biodiversity should be minimal. The HMA management for RCWs would in essence be protecting species within these areas that are sensitive to fragmentation or dependent on large trees.

In RCW populations where 3/4-mile radius circles do not overlap or where overlapping circles make up only a small area, HMA size will be inadequate to avoid or overcome the effects of fragmentation. Biodiversity may be adversely affected as the interstitial spaces (area between nonoverlapping 3/4-mile circles) are regenerated. Habitat may become fragmented, populations of various species that are sensitive to fragmentation may become isolated from one another, and populations may decline.

Species that are generalists or associated with early successional habitat should benefit from the regeneration of interstitial spaces. These species may see increases in both density and distribution at the expense of habitat specialists.

Alternative B: In Alternative B, HMAs are not identified. Management of RCWs is based on active clusters and adjacent foraging habitat. Opportunities for habitat fragmentation and isolation of groups are greatest in this alternative, especially in small, widely dispersed RCW populations. There is a high probability of effects on populations of RCWs and other species that are sensitive to fragmentation because they may become isolated from one another, affecting dispersal and reproduction. Habitat generalists and species needing soil disturbance should benefit from all the regeneration that could occur in this alternative. Habitat generalists should see increases in density and distribution, to the detriment of habitat specialist and rare species.

Alternative C-E: Establishing HMAs in these alternatives would allow an ecological approach to RCW recovery. HMA size is dependent on population objective and habitat quality. The continuity of communities over large areas should preclude isolation of populations of various species and should be beneficial to conserving biological diversity. Habitat generalists and early successional species may be affected, with decreases in population densities and distributions.

Cumulative Effects

Alternative A: In large, dense RCW populations with overlapping 3/4-mile circles, adverse cumulative effects on biodiversity should be minimal. The RCWs would be protecting, through time, the habitat for species sensitive to fragmentation or dependent on large trees. Fragmentation could occur on private and corporate lands within 3/4-mile circles because of the likelihood of short rotations on these acres. There are very few RCW populations that are currently large and dense.

In RCW populations where 3/4-mile radius circles do not overlap, adverse cumulative affects could occur because of continual fragmentation of habitat within interstitial spaces. There is also a probability of short rotation and habitat modification on adjacent private and corporate lands (USDA Forest Service 1988).

The combination of short rotations and habitat modification on private lands and the likelihood of habitat fragmentation outside 3/4-mile zones may lead to demographic isolation of RCW groups and other area-sensitive species (Wilcove et al. 1986). As habitat gets more fragmented, populations become more isolated on smaller patches of habitat, become more prone to severe demographic stochasticity, and are more susceptible to extinction (Wilcox and Murphy 1985, Gilpin and Soule' 1986). The effects to early successional species should be similar to those disclosed under indirect effects.

Alternative B: The cumulative effects would be similar to Alternative A, except there is a much greater probability of habitat fragmentation and demographic isolation because only active clusters, replacement, and recruitment stands would be protected. This could lead to population declines of RCW and other area-sensitive species with the most serious effects in smaller populations (Shaffer 1981, Gilpin and Soule' 1986, Goodman 1987.

Alternatives C-E: The cumulative effects of establishing HMAs will be large patches of mostly late successional habitat scattered across the landscape. Minimum HMA size will be 6,150 acres (10 square miles) and total acres involved in HMAs, including suitable and unsuitable RCW habitat, may exceed three million acres (almost 4,700 square miles). Managing large blocks of land scattered across the landscape should preclude any adverse effects from fragmentation. Smaller populations of any given species should find suitable conditions for population growth and expansion. Early successional species may occur at lower densities on National Forest lands within HMAs. The likelihood of short rotations and habitat modification on adjacent private and corporate lands should help meet the needs of early successional species. There should be no adverse effects on biodiversity from HMA delineation.

ESTABLISHING REPLACEMENT AND RECRUITMENT STANDS

Stand Level

Alternatives A-E

Direct Effects

There will be no direct effects on any species by establishing replacement and recruitment stands because establishment consists of designating the area on a map. There is no physical management involved in this step.

Indirect and Cumulative Effects

Clusters, replacement, and recruitment stands have no rotation; therefore, the trees in these sites would become old, and eventually reach pathological rotation and die. In the southern yellow pine forests, there are no known old-growth obligate species. Species dependent on large trees would benefit whether the trees are alive or dead. Some of these species include American swallow-tailed kite, southeastern American kestrel, and eastern screech owl.

With proper management of stand structure using prescribed fire and silvicultural methods, any adverse effect to early successional species should be avoided. In Mississippi and Texas, early successional bird species have been observed singing on territories in RCW clusters. Some of these species include blue grosbeak, indigo bunting, painted bunting, yellow-breasted chat, northern bobwhite, and common yellowthroat (Brennan et al. 1995, R.N. Conner, personal communication 1994).

Landscape Level

Alternatives A-E: The direct and indirect effects should be similar to those disclosed at the stand level.

Cumulative Effects

As new active clusters develop, additional replacement stands would be identified. Eventually, total acres would be the same as identified previously for protection of clusters, replacement and recruitment stands. These would provide additional acreage to develop into larger, older trees, providing more habitat for species dependent on large trees.

Species dependent on early successional habitat should not be adversely affected because their habitat requirements should be available on adjacent National Forest lands, and would likely be abundant on adjacent private and corporate lands. There should not be any decrease in species diversity at the landscape level.

CLUSTER, REPLACEMENT, AND RECRUITMENT STAND PROTECTION

Alternatives A-E

Indirect and Cumulative Effects

Protection of these stands, all a minimum of 10 acres in size, will create areas occupied by very old trees, thus contributing to the biodiversity within the areas being managed. Alternative A would provide approximately 88,000 acres of such habitat, Alternative B, 125,000 acres and Alternatives C-E, 186,000 acres each.

With proper management of stand structure, the aging of these stands should not affect species requiring early successional habitat.

MIDSTORY CONTROL IN CLUSTERS, REPLACEMENT, AND RECRUITMENT STANDS

Stand Level

Alternatives A-E

Direct Effects

There should be minimal effects of midstory removal on biodiversity. Any vegetation control method except herbicide will result in resprouting, resulting in no change in plant species diversity. Even herbicide treatment will not have a direct effect on species diversity, as it may take a year or more to kill treated vegetation.

Indirect Effects

The indirect effect of midstory control is similar for all alternatives. The acres to be treated vary, with Alternatives A, B, C, D, E treating 88,000; 125,000; 186,000; 186,000 and 186,000 acres respectively.

There are variable effects of midstory removal and control on biodiversity. Midstory removal and control would allow more sunlight to reach the forest floor and stimulate growth of the herbaceous understory benefitting plants and producing more forage for numerous species of animals.

Midstory removal will affect stand structure and may displace certain shrub and midstory nesting bird species. Removal of midstory hardwoods will create habitat conditions suitable for ground nesting species such as Bachman's sparrow. If herbicides are used to control hardwoods and all existing stems of a given species are treated, that species may be eliminated from the stand. This may or may not decrease total within-stand diversity, depending on if species eliminated from the stand are replaced by species new to the stand.

Cumulative Effects

Alternative B: As long as a midstory hardwood component is maintained (less than 20 square feet of basal area), there should be no adverse effects on existing biological diversity. Prescribed burning may change herbaceous species composition. If herbaceous species composition changes, there should be an increase in within-stand diversity.

Alternatives A, C, D, and E: Midstory removal and control may have cumulative effects on biodiversity. Hardwood midstory species will likely be eliminated from clusters, and replacement and recruitment stands. Associated with this loss of structure, will be a loss of bird species that need hardwood midstory for nest sites. Growing season prescribed fires will change the herbaceous plant community and should enhance plant species diversity. Changes in herbaceous structure may enhance nesting conditions for ground nesting bird species. Whether within-stand diversity increases or decreases depends on how individual species respond to the changes in management. The herbaceous component is inherently more diverse than the midstory hardwood community; therefore, it is likely that there may be an increase in within-stand species diversity.

Landscape Level

The direct, indirect, and cumulative effects of midstory control in clusters and replacement and recruitment stands would be the same as those disclosed at the stand level. More stands would be affected across the landscape, but there should not be any noticeable changes.

CAVITY RESTRICTORS

Direct Effects

Cavity restrictors will not have direct effects on biodiversity at the stand or landscape scale.

Stand Level

Alternative A-E

Indirect and Cumulative Effects

Primary and secondary cavity nesters that need entrance holes greater than 1.5 inches could be adversely affected because of reduced numbers of cavities available. Species that would be affected include, but are not limited to, pileated woodpecker, red-bellied woodpecker, eastern screech-owl, and great crested flycatcher. Species needing entrance holes less than 1.5 inches, eastern bluebird, brown-headed nuthatch, and southern flying squirrel, would not be adversely affected. There may be a beneficial effect on these species because of reduced competition from larger birds. At the stand level, there may be a decrease in species diversity because of the displacement of the larger cavity nesters. If large snags are retained in clusters, there should be no affect on biodiversity.

Landscape Level

Alternative A-E

Indirect and Cumulative Effects

The effects of using restrictors should be negligible in all alternatives. Only a small percentage of available cavities in a forest are active RCW cavities and only RCW cavities would have restrictors. Therefore, the vast majority of cavities would still be available for cavity dependent species. There may be slight effects on distribution and abundance, but no effect on species diversity.

TRANSLOCATION

Effects of translocation on biological diversity will be restricted to genetics, unless new clusters are created in previously unoccupied habitat. If new clusters are created in previously unoccupied habitat, there is the potential for effects on the flora and fauna. This is not tied directly to the translocation, but rather to the habitat management necessary to create and maintain suitable RCW habitat.

Landscape Level

Direct Effects

There will be no direct effects of translocation on genetic diversity for any alternative. Moving an individual into a population does not have effects on genetic diversity. For potential genetic effects to occur, the offspring of translocated birds must successfully reproduce and have their young recruited into the population.

Indirect and Cumulative Effects

Any translocation that results in successful reproduction has the potential to affect genetic diversity. In small populations, translocation will be essential to avoid potential adverse effects of inbreeding. All Forest Service RCW populations appear to be genetically isolated from one another, because of habitat fragmentation. Translocation will ensure genetic interchange among populations, but care should be used to select donors from geographically similar areas (Stangel et al. 1992, Haig et al. 1993).

ARTIFICIAL CAVITIES

Direct Effects

Installing artificial cavities will not have a direct effect on biodiversity.

Indirect and Cumulative Effects

Installation of artificial cavities will likely have indirect and cumulative effects on biological diversity. The addition of new cavities to the forest will likely provide addition nest and roost sites for the numerous secondary cavity users that inhabit the forest. It is very likely that their abundance and distribution will increase as the result of an aggressive artificial cavity program.

HABITAT MANAGEMENT

PRESCRIBED BURNING

Prescribed burning is used in all alternatives. Effects would be similar in all alternatives. The differences are associated with magnitude of treatment area. Alternative B primarily treats clusters and replacement and recruitment stands. All other alternatives treat all RCW habitat, resulting in more acres treated. Prescribed burning primarily affects stand structure which indirectly affects biodiversity. Alternatives C, D, and E emphasize growing season burning, but burning will occur throughout the year because of the magnitude of the prescribed burning program. Caution must be used when placing fire control lines. Where possible, natural control lines (streams, rivers, swamps, etc.) should be used. In the past, fire control lines were often plowed along or through transition zones. This excluded fire and allowed the development of brushy conditions, which could adversely effect the herbaceous plant community. Numerous PETS plant species are known to occur in transitional habitats including roughleaf loosestrife and Florida skullcap. Plowed fire control lines can also affect hydrologic patterns.

Direct Effects

There will be no direct effects of prescribed burning on species diversity at the stand or landscape level for any alternative. There may be effects to individuals. The eastern glass lizard is known to have been killed by prescribed burning. The eggs or nestlings of ground or shrub nesting birds may be destroyed. Food and cover are lost. Insects that cannot fly or that do not burrow into moist humus or soil will likely be burned.

Stand Level

Indirect Effects

Prescribed burning should not have indirect effects on plant species richness. Prescribed burning will affect vegetative structural diversity, which may affect bird species diversity. Bird species most likely to be affected are those requiring shrubby vegetation for nest sites. If a particular bird species can not find suitable nesting substrate within the stand, it will be eliminated from the stand and represent a decrease in within stand species diversity.

Although food and cover are destroyed with the burn, there is almost an immediate response of new vegetative growth. This vegetation is more palatable and there is often an increase in seed and fruit production (Stransky and Halls 1976, 1980, Stransky and Roese 1984). Hurst (1972) found significantly more insect biomass available to quail broods in burned versus unburned areas. The increase in insect biomass could lead to increased utilization by turkey and quail broods, with the ultimate result of better poult and chick survival. The increased production of herbaceous vegetation could lead to an increase in small mammal populations, which may result in increased use of the stand by predators ranging from snakes and foxes to hawks and owls.

Cumulative Effects

There will be cumulative effects of prescribed burning on within-stand diversity.

Prescribed burning will have cumulative effects on vegetation (Waldrop et al. 1987). Regularly repeated burns, particularly growing season burns, may eliminate some species of hardwood trees and shrubs and may significantly change vegetation structural diversity. While some species may be eliminated from a stand because of growing season burns, other species such as dwarf live oak, runner oak, chaffseed, and wiregrass will be enhanced or reestablished in a stand, if a seed source is present. There are more than 100 PETS species of plants associated with red-cockaded woodpecker habitat that would benefit from prescribed burning.

Dickson et al. (1984) stated, in general, as the vegetational complexity of a stand increases, so does bird species diversity. Conversely, one could conclude as the vegetational complexity of a stand decreases, so does bird species diversity.

Changes in vegetation structural diversity, will affect bird species diversity (Mac Arthur and Mac Arthur 1961, Karr and Roth 1971, Willson 1974, Dickson and Segelquist 1979, Landers 1987). Dickson (1981) stated, prescribed burning favors bird species closely associated with pine stands, and burning selects against bird species dependent on deciduous canopy foliage, midstory trees, or litter accumulation.

There has been little research done on the effects of prescribed fire on herpetofauna. Means and Campbell (1981) stated that the available data indicates prescribed burning benefits most herpetofaunal species native to southern pine forests. Means and Campbell (1981) studied the effects of summer burning in longleaf pine flatwoods and documented use by 26 species of herpetiles throughout the burn area. Species dependent on surface cover did not show a population decline after the burns.

In summary, prescribed burning at the stand level should increase within-stand diversity. Even though some species may be eliminated or displaced from a stand, the conditions that could be created are suitable for more species, particularly plants, than the number of species potentially eliminated. Treated stands should begin to develop a structure and species composition similar to those that likely existed historically.

Landscape Level

Alternative B: The indirect and cumulative effects of prescribed burning at the landscape scale should be similar to those disclosed for stand level. This is because treatments are concentrated in clusters (stands). At the landscape level, there would be scattered stands treated across the landscape, resulting in stand level impact scattered across the landscape.

Indirect Effects

Alternatives A, C, D, and E: Prescribed burning should not have indirect effects on species diversity at the landscape scale. Prescribed burning will affect vegetative structural diversity, which may affect distribution and abundance of various vertebrate and invertebrate species. At the landscape scale, all acres are not treated at the same time; therefore, opportunities exist for species to move between stands to find suitable habitats.

Cumulative Effects

Alternative A: The cumulative effects of prescribed burning at the landscape scale will vary depending on density of RCW clusters. In dense populations with several overlapping 3/4-mile radius circles, effects should be similar to Alternatives C, D, and E. The overlapping 3/4-mile radius circles would in effect function as a large HMA. In sparse populations where 3/4-mile radius circles do not overlap, it is questionable if landscape level effects would occur. The 3/4-mile radius circles would likely be isolated islands of suitable RCW habitat surrounded by unsuitable habitat. The cumulative effects would probably be more similar to those disclosed at the stand level.

Alternative C, D, and E: These alternatives utilize Habitat Management Areas and therefore have the potential for cumulative effects at the landscape level. Of all the natural disturbance forces exerting change on the landscape, only fire has been readily controlled by man. Control of fire and other alterations of natural processes have markedly influenced the structure, functions, and composition of most ecosystems (Samson 1992). Hobbs and Huenneke (1992) stated suppression of fire in ecosystems dominated by fire adapted species can severely disrupt ecosystem processes, which may have implication for the conservation of native, fire-tolerant species.

Overall cumulative effects on biodiversity should be positive, even though some species may experience changes in distribution and density and some species may be eliminated from individual stands.

Growing season burns may eliminate some species of hardwood trees and shrubs from pine uplands and flatwoods, and will change vegetative structural diversity. The species eliminated from the uplands and flatwoods will not be eliminated from the landscape. These species will be found in transition zones between swamps and uplands and hardwood drains and uplands. This is probably where these species occurred historically under a natural disturbance regime. Some of the loss of vegetative structural diversity may be compensated for by an increase in abundance and increased distribution of fire dependent shrubs such as runner oak and dwarf live oak.

At the landscape level, there should not be any loss of avian species diversity. There will be changes in abundance and distribution. Shrub and midstory dependent species will decrease in abundance, in suitable RCW habitat. These species will be found in hardwood stands and transition zones, where they likely occurred historically (Landers 1987). Ground nesters needing open stands such as Bachman's sparrow, northern bobwhite, and Chuck will's widow should increase in abundance and distribution as the shrub and midstory layers are controlled. Brennan et al. (1995) presented some preliminary results of a study in Mississippi analyzing the effects of RCW management on nontarget vertebrates. Their breeding bird counts indicated 100 percent of Bachman's sparrow and 80 percent of northern bobwhite occurred in areas managed for RCW. Conversely, 94 percent of red-eyed vireo and 97 percent of hooded warbler counts occurred in mature pine stands that were not managed for RCW. These species are typically associated with deciduous shrub and midstory vegetation and were present because of the vegetative structural diversity.

Brennan et al. (1995) also compared small mammal use of pine stands managed for RCW with similar pine stands not managed for RCW. Sixty percent of all captures occurred in stands managed for RCW. Only one species, the white-footed mouse, occurred in all stands sampled in both RCW managed and unmanaged stands, and accounted for 52 percent of total captures. Looking at the data without the white-footed mouse, shows 71 percent of captures occurred in stands managed for RCW. Of the captures occurring in RCW managed stands, 51 percent were shrews.

Seventy eight percent of all shrews captured occurred in stands managed for RCW. Shrews are insectivorous and it could be concluded the abundance of shrews in RCW-managed stands indicate an abundance of insects and prescribed burning should benefit invertebrate communities. The biggest small mammal prey item in their study (Brennan et al. 1995) was the hispid cotton rat, and it was only captured in stands managed for RCW.

Any species that utilizes small mammals as its prey base should benefit from the cumulative effects of prescribed burning. At the landscape level, there probably will not be any increase in species diversity of predator or prey, but there will be changes in abundance and distribution. Increased prey abundance and decreased midstory vegetation in areas managed for RCW should result in increased foraging efficiency of hawks and owls, which should lead to increases in raptor densities. Increased prey availability should benefit numerous PETS species including southeastern American kestrel, eastern diamondback rattlesnake, eastern indigo snake, and black, northern, Florida, and Louisiana pine snakes.

Prescribed burning will control midstory vegetation and may eliminate some species at the stand level, including species capable of producing mast. Many wildlife species are dependent on mast for food. Wildlife species dependent on mast may be affected at the stand level with changes in abundance and distribution, but there should not be changes in mast availability at the landscape level.

Alternatives C, D, and E allow for the retention of some overstory hardwood trees, which should be capable of producing mast. Suppressed midstory species that would probably be eliminated, do not produce large quantities of mast (Burns et al. 1954, Sharp and Sprague 1967, Goodrum et al. 1971). The removal of midstory combined with growing season burning should stimulate growth, development, and mast production of runner oak and dwarf live oak (Williams 1977). Returning to a more natural fire regime should not adversely affect major game species (Johnson 1987, Landers et al. 1989).

The mast-dependent species most likely to be affected by the cumulative effects of prescribed burning is the gray squirrel. Landers (1987) stated in frequently burned pine-dominated forests, gray squirrels will be found primarily in upland hardwood islands, hardwood drains, and bottomland hardwood stands. This is likely where gray squirrels occurred historically under a natural disturbance regime.

The effects of prescribed burning on soil and nutrient cycling has been well documented (Metz et al. 1961, Ralston and Hutchell 1971, Wells 1971, Jorgenson and Wells 1971, Lewis and Harshbarger 1976, McKee 1982, and Waldrop et al. 1987). Ralston and Hatchell (1971) concluded large changes in soil physical properties could occur from high intensity wildfire, but changes would not be expected to occur from low intensity prescribed burning because unburned organic matter protects the soil. Jorgenson and Wells (1971) stated prescribed burning increased nitrogen fixation by soil microorganisms. Waldrop et al. (1987) stated total nitrogen content of the forest floor was significantly reduced by all burning treatments because of reduced accumulation of litter. However, nitrogen content of mineral soil increased slightly with winter or summer burns. Prescribed burning consistently increased the amount of available phosphorus in mineral soils (McKee 1982). Waldrop et al. (1987) stated that even though unknown quantities of nutrients were lost to the atmosphere during burning, the major effects of fire were apparently a stimulation of nitrogen fixation and a redistribution of nutrients from the understory and forest floor to mineral soil. In regard to water quality, Richter et al. (1982) stated hydrologic fluxes of nitrogen, phosphorus, sulfur, and basic cations, from burned pine litter to ground and stream water, are not likely to have appreciable impacts on water quality.

The effects of prescribed fire on fungi are not well documented. The role of fungi in the forest's nutrient cycling process as primary decomposers and mycorrhizal formers has been documented, primarily from the Pacific Northwest (Harvey et al. 1980, Fogel and Hunt 1983, France and Reid 1983, and Parke et al. 1983). In the southeast, O'Halloran et al. (1987) indicated prescribed fire did not alter production or nutrient quality of fleshy fungi. With no effect on production or nutrient quality, the indication is that prescribed fire should not affect the ecological function of fungi in the forest's nutrient cycling process.

In summary, prescribed burning at the landscape level with a more natural disturbance regime should have positive cumulative effects on biological diversity. Some species will decrease in abundance, while others will have increases. Through time, plant and animal communities should become more reflective of historical conditions. There should be no adverse effects on ecosystem function.

THINNING

Stand Level

Alternatives A-E

Direct Effects

There will be no direct effect on species diversity or associations. There is a remote possibility of direct effects to individual animals. Direct effects would only occur if there was a nest or den in a given tree being cut, if the cut stem crushed a nest or individual, or if logging equipment crushed a nest or individual. Plants are more likely to be affected as the result of crushing or uprooting. Thinning will directly affect structural diversity through reduction in the number of trees per acre.

Indirect Effects

It is unlikely that species diversity will be indirectly affected by thinning. There will be effects to individuals in regard to abundance and distribution. Thinning pine stands increases production of fruits, forage, seeds, and herbaceous vegetation and should be beneficial to deer, turkey, quail, and numerous other species including songbirds and small mammals (Stoddard 1931, Blair 1960, Rosene 1969, Grelen and Enghardt 1973, Halls 1973a, 1973b, Sanderson and Schultz 1973, Blair and Enghardt 1976, Walters 1981, Hurst and Warren 1982, and Harlow et al. 1990). Blair (1969), stated forage and fruit production for deer on forest lands is inversely related to timber stand density, the higher the stem density the less forage produced. Any species dependent on herbaceous vegetation should benefit from thinnings, including insects.

With the increase in insects and small mammals (the prey base), there should be an increase in predators ranging from snakes and small birds to hawks and owls. There could be indirect adverse effects on plants if heavy equipment used during the thinning operation changes the hydrology of the site.

The reduction in stem densities through thinning should have adverse effects on southern pine beetle abundance and distribution. Thinning is an effective tool for reducing the risk of southern pine beetle infestation in pine stands (Hedden 1983, Brown et al. 1987, Belanger 1989). The reduced losses of pines to southern pine beetle should benefit any species needing live pine trees for part of its existence.

Cumulative Effects

Thinning usually reduces the structural complexity of the canopy allowing more sunlight to reach the understory and forest floor, promoting higher plant species diversity (Norse et al. 1986).

Bird species diversity is closely related to numerous vegetative characteristics including life-form of the vegetation (Pitelka 1941), foliage height diversity (MacArthur and MacArthur 1961, Karr and Roth 1971, Willson 1974, Dickson and Segelquist 1979, and Kroodsma 1984), and plant species diversity (Karr 1968, Tomoff 1979). Generally speaking, as the vegetational complexity of a stand increases, so does the bird species diversity (Dickson et al. 1984). Thinnings generally enhance conditions for the development of understory vegetation, which should increase bird species diversity (Noble and Hamilton 1975, Meyers and Johnson 1978, Wood and Niles 1978, Kroodsma 1984, and Harlow and Van Lear 1987). However, when thinning is combined with prescribed burning, hardwood midstory and understory shrubs will be reduced or eliminated resulting in decreased structural diversity and a likely decrease in bird species diversity.

Repeated thinnings through time should provide for stability in the understory vegetation component and structure. Stability of the vegetative component should provide stability in the species associations for a given stand. Any species dependent on dense pine stands could be adversely affected. Continued thinnings through time should ensure reduced risk of southern pine beetle infestation.

Landscape Level

Alternatives A-E

Direct Effects

Thinning will not directly effect species diversity, species association or community stability at the landscape level. Direct effects will be similar to those disclosed at the stand level.

Indirect Effects

Thinning should not have indirect effects on species diversity at the landscape scale. There could be effects to individuals, populations densities, and distributions. The effects will be similar to those discussed at the stand level with the effects scattered throughout the landscape. The reduction in pine stem density and changes in vegetative structure across the landscape should increase foraging efficiency of avian predators. This could increase survival rates of young hawks and owls.

The increased sunlight reaching the forest floor would be beneficial to plants with light requirements ranging from filtered sun to partial shade. Individual plants should be more vigorous and produce more fruiting bodies, resulting in growth of individual populations scattered across the landscape. Plant species requiring full shade may be adversely affected and see decreases in vigor and seed production. If heavy equipment used during thinning operations or any associated road construction change hydrologic patterns, there could be decreased vigor in entire plant communities.

The affects of thinning on the reduction of risk for southern pine beetle infestation should be similar to those disclosed at the stand level.

Cumulative Effects

Repeated thinnings through time should result in a landscape with fewer trees/acre and reduced structural complexity of the canopy. Norse et al. (1986) stated more sunlight reaching the understory and forest floor should promote higher species diversity. This may be true at the stand level, but it is unlikely thinning will increase species diversity at the landscape level. Thinning could influence population densities and distributions of species.

Brennan (1991) stated northern bobwhite populations were declining at an alarming rate over the last 30 years, and the southeastern United States was having the most drastic declines. He stated that clean farming practices and silvicultural systems that maximize basal area are the most likely causes for the decline. Reduced basal areas and increases in production of insects, seeds, and herbaceous vegetation, should result in increases in population densities and distributions of bobwhite quail across the landscape. With more open pine stands, improved brood habitat and increased forage production, deer and turkey populations should at least remain stable.

The habitat conditions created across the landscape should be beneficial to numerous PETS animals including, but not limited to, Bachman's sparrow, Florida mouse, Florida burrowing owl, southeastern American kestrel, and gopher tortoise. Increases in gopher tortoise densities and distribution should benefit numerous other PETS animals directly associated with tortoise burrows. These species include eastern indigo snake, black pine snake, northern pine snake, Florida pine snake, Louisiana pine snake, eastern diamondback rattlesnake, Florida gopher frog, Carolina gopher frog, dusky gopher frog, Aphodius tortoise commensal scarab beetle, Copris tortoise commensal scarab beetle, Onthophagus tortoise commensal scarab beetle and two species of tortoise commensal noctuid moth. None of these above listed PETS species are known to currently have a stable or increasing population (USDI Fish and Wildlife Service 1994).

Plant species with light requirements ranging from filtered sun to partial shade should have increases in population densities and distributions as a result of repeated overstory thinnings through time. Plant species requiring full shade may have decreases in population densities and changes in distributions. Distributional changes would likely be from pine habitats to more shaded transition zones and hardwood pine habitats, if soils and hydrology are suitable. If heavy equipment used during thinning operations or any associated road construction change hydrologic patterns, there could be changes in entire plant communities.

Repeated thinnings through time should provide for stability in the understory vegetation component and structure. Stability in vegetative structure should create fuel conditions more suitable for effective growing season burns. Stability in plant communities should provide stability in the species associations across the landscape. The landscape conditions created should ensure reduced risk of southern pine beetle epidemics.

Regeneration

Overview

The effects of regeneration on biological diversity would vary with regeneration method and intensity of site preparation. Any silvicultural practice may be temporarily beneficial to certain species while detrimental to others (Perkins 1974, Noble et al. 1980, Crawford et al. 1981).

Effects of Regeneration

Stand Level

Direct Effects

Direct effects will be the same for all alternatives. Regeneration could have direct effects on biological diversity at the stand level. There will be effects on individuals and could be effects on species diversity. Direct effects will vary by stand condition, regeneration method, and season. If an area is harvested in fall or winter, the effects include loss of late successional habitat and those species dependent on this condition, if the area is harvested by clearcutting or shelterwood methods. Birds are most likely to be affected. Any decrease in species diversity is most likely due to total displacement of individuals and home range shifts rather than death of all individuals of a given species.

Possible effects during the spring and summer (nesting season) include, loss of potential nesting or denning sites, and the loss of a given years reproductive output if nests or dens are destroyed or abandoned.

Uneven-aged regeneration techniques are least likely to have direct effects on wildlife. All age/size classes will be present within an area. Wildlife is not likely to be totally displaced from an area.

It is unlikely regeneration will directly affect plant species diversity. There will be effects on individuals, the most obvious being the harvest of mature trees. Other effects could include the crushing or uprooting of individual plants during the harvest operation. Because of repeated entries into a stand with uneven-aged methods, there is a higher likelihood of direct effects on herbaceous plants when compared to even-aged methods.

Indirect Effects

Indirect effects at the stand level will generally be the same for all alternatives because species responses to overstory removal are generally the same regardless of rotation length. Regeneration indirectly affects biodiversity in many ways. Cutting mature pines will reduce available pine mast for wildlife species including Sherman's fox squirrel. The loss of pine mast should be offset by increases in browse, fruits, seeds, and forage if even-aged regeneration methods are used (Blair 1960, 1969, Grelen and Enghardt 1973, Halls 1973a, 1973b, Blair and Enghardt 1976, Walters 1981, Hurst and Warren 1982).

The major game species (deer, turkey, and quail) should benefit from the increase in available food and cover. Deer and turkey may not use the interior of the larger patches that could occur in Alternatives A, B and C. Small mammal populations within the stand should increase resulting in greater utilization by raptors.

Conner et al. (1981) found regular use of clearcuts in Texas by raptors, if perch sites were present. Uneven-aged regeneration systems would produce less food for deer and turkey when compared to even-aged methods (Murphy and Crawford 1970). The stand structure created from uneven-aged management may reduce foraging efficiency of hawks and owls.

Indirect effects of regeneration on birds varies by habitat requirements of a species. Early successional species such as prairie warbler or indigo bunting should find suitable habitat in areas harvested by clearcutting or seed-tree and shelterwood methods, and may represent species additions to the stand. Late successional species would not likely find suitable habitat in these stands. If relict trees and snags are retained, or if the stand was regenerated by irregular shelterwood or uneven-aged methods, habitat should be available for late successional or snag dependent species such as red-headed woodpecker, blue jay, and great crested flycatcher.

If suitable soils exist, the open conditions and increases in herbaceous vegetation associated with regeneration activities should benefit gopher tortoise. If gopher tortoise benefit, there is the potential to benefit at least 15 other PETS animal species.

There is the potential for dramatic effects on plant communities. Overstory removal and the associated modification of midstory and understory vegetative structure could adversely affect plant species needing shade for their existence. Shade dependent species may be eliminated from a stand harvested by clearcutting or seed-tree and shelterwood methods. Conversely, plant species needing full sun and soil disturbance to become established (early successional species) should benefit and could represent species additions to the stand. Many of the plant species that existed prior to harvest may not be affected, if soil disturbance is kept to a minimum. In general, the more basal area removed and the greater the soil disturbance, the greater the likelihood of changes in plant communities. This is particularly true of site preparation. The more intensive the site preparation, the greater the potential for changes in plant communities. Harvest and site preparation may also alter hydrologic patterns, which could affect plant communities.

As a stand grows through various stages, species associations will change. The progression of communities for standard even-aged regeneration methods would go from early succession to mature and overmature conditions, depending on pine species and rotation length. The progression of communities for the group selection method should be similar to those just described except at a much smaller scale, with maximum patch size of 2 acres. Irregular shelterwood and single-tree selection may have more stable species associations because overstory trees are retained on every acre. Regeneration patch size may affect re-colonization rates and distributions of species, particularly plants. If a species is lost from a stand, it generally will take longer to recolonize the interior of a large patch when compared to a small patch. Recolonization rates may be slower in Alternatives A, B and C which allow regeneration units up to 80 acres in size.

Regeneration methods and intensity of site preparation can have tremendous effects on plant and animal communities. The most intensive method (clearcutting) combined with intensive mechanical site preparation and planting can totally alter community integrity. Intensive site preparation could alter hydrologic conditions also affecting plant communities. Natural regeneration methods utilizing site preparation prescribed burns will have the least effect on plant and animal communities.

Cumulative Effects

Cumulative effects of regeneration at the stand level depend on how often a stand is re-entered for regeneration purposes. With even-aged regeneration techniques and rotations addressed in this EIS, the shortest reentry period for regeneration would be 70 years, the longest 200 years. With uneven-aged regeneration methods, reentry into a stand could be as often as every 3 to 15 years.

To properly analyze cumulative effects of regeneration on biological diversity at the stand level, one must compare plant and animal communities at the time of regeneration with those likely to occur at the time of future harvests. The progression of communities following regeneration, from early successional conditions to mature forest are all indirect effects of harvest.

Even-aged regeneration methods should not have cumulative affects on plant communities, at the stand level. Even with the shorter rotations in Alternative B, 80 years for longleaf pine and 70 years for other yellow pines, plant communities should fully recover over the life of the stand, unless intensive soil disturbing site preparation occurs.

Uneven-aged regeneration methods may have cumulative affects on plant communities at the stand level. Any cumulative affects that may occur would primarily be caused by repeated entries into the stand, increased roading needs, and increased soil compaction. If a stand is entered every 3 to 15 years, the temporary roads and skid trails would likely only be able to develop early successional plant communities before they would be disturbed again, and the process started over. Increased entries would compact skid trails and temporary roads which could inhibit recolonization of their surface. The temporary roads and skid trails may alter hydrologic patterns and may also affect fire behavior. Any effect to hydrology or fire behavior could affect plant community development.

Clearcutting, shelterwood, or uneven-aged regeneration methods may have cumulative affects on certain bird species. On poorer sites with the shorter rotations, or rotation age equivalent used to set maximum diameter limits in uneven-aged management in Alternative B, trees may not be large enough for the larger primary and secondary cavity nesters. Species that may be affected would include pileated woodpecker, American kestrel, and screech owl. If suitable size nesting trees do not develop during the life of the stand, these species will be displaced, as breeders, from the stand. They may use the stand for foraging purposes. Uneven-aged management may also have cumulative affects on early successional bird species. Patch sizes from single-tree selection may not be large enough to create suitable nesting habitat for some early successional bird species. If suitable nesting habitat is not developed, these species could be displaced from the stand.

Irregular shelterwood methods which retain the overwood should not have cumulative affects on plants or animals at the stand level.

Landscape Level

Direct Effects

Direct effects will be the same for all alternatives at the landscape scale. Total species diversity at the landscape level should not be affected by regeneration. Individual stands within the landscape will see additions and deletions in species numbers. There will be effects on distributions and abundance. Direct effects of regeneration at the landscape scale should be similar to those disclosed at the stand level, except the effects would be distributed across the landscape.

Indirect Effects

Regeneration indirectly affects biological diversity in many ways. At the landscape level, regeneration should not affect overall species diversity. There will be changes in distributions, abundance, vegetative structural diversity, and species associations. The most noticeable changes will be in vegetative structure. Wilcove et al. (1986), Franklin (1988), and Landres (1992) all state managing native biodiversity requires maintaining an array of successional stages typically occurring in a landscape. Even-aged regeneration areas will provide early successional habitat scattered across the landscape.

The indirect effects at the landscape level should be similar to the indirect effects disclosed at the stand level. There could be increases in population densities and there should be changes in home ranges or territories to utilize the newly available resources. Home range or territory changes will be influenced by the array of regeneration patches on the landscape. Deer and turkey may not use the interior of the larger patches that could occur in Alternatives A, B and C. Landscape pattern will affect raptor distributions.

The stand structure created from uneven-aged management may reduce foraging efficiency of hawks and owls.

Indirect effects of regeneration on birds varies by habitat requirements of the species and regeneration method used. Even-aged silvicultural techniques should result in increases in abundance and distribution of early successional species. These same techniques could result in decreases in abundance and distribution of late successional species which would be displaced to adjacent suitable habitat. Thompson et al. (1992) found forest interior birds often used transition zones around clearcuts and densities of some species may increase because of harvesting. Birds were probably attracted to the transition zones because of increased vegetative structural diversity.

Dickson et al. (1989) stated as vegetative structural diversity increases, so does bird species diversity. Irregular shelterwood and uneven-aged regeneration systems would have greater structural diversity and therefore should provide for more bird species per unit area. Uneven-aged regeneration methods may not create large enough patches of suitable habitat for some early successional bird species. Group selection management will result in much more edge and associated "edge effect" than even-aged regeneration methods. Thompson (1993) used computer models to simulate forest interior bird population responses to forest management options. His modeling indicated only 0.2 percent of nests would be farther than 650 feet from an edge with group selection management.

Forest interior birds may be affected by group selection management. Thompson et al. (1992) stated in extensively forested areas early successional birds species had the most limited distributions and were dependent on timber harvest or natural disturbance to create habitat. Bird species associations will be closely related to the pattern of regeneration areas on the landscape.

The indirect effects of regeneration on plant communities at the landscape level should be similar to those disclosed at the stand level. Overstory removal and the associated modification of vegetative structure will affect plant communities, but should not affect total plant species diversity or viability across the landscape. Plant species may be gained or lost within stands depending on habitat conditions, but there should be no net change in total plant species at the landscape level. The more basal area removed and the greater the soil disturbance, the greater the likelihood of changes in plant communities. Any changes in hydrologic patterns caused by road construction, harvest, or site preparation could also affect plant communities.

At the landscape scale, plant and animal communities are constantly in a state of flux. The pattern of regeneration areas on the landscape can influence plant and animal distributions and associations. If wind currents are affected by regenerated patches, there will be effects on the distributions and establishment of light seeded plant species that are disseminated by wind. The utilization of regeneration areas by wildlife may also affect plant distributions. Some plant seeds have adaptations to help them stick to animals to aid in dispersal. After the seeds cling to the animal, they are dispersed as the animal travels through its territory, which could include regeneration areas.

Other seeds are adapted to pass through an animal's digestive tract without losing viability of the seed. These seeds are deposited in the droppings of animals. Many species of animals including raccoon, grey fox, red fox, black bear, opossum, and many birds regularly have seed in their droppings (Howe and Smallwood 1982, Hoppe 1988, Stiles 1989, Robinson and Handel 1993, McClanahan and Wolfe 1993). All of these species are known to use early successional habitat and could deposit seeds in regeneration areas as well as elsewhere in their territories, thereby affecting plant distributions.

Cumulative Effects

Regeneration will have cumulative effects on biological diversity, at a landscape scale. It is unlikely any species will be eliminated from the landscape by even-aged regeneration methods, although species will be temporarily eliminated from stands within the landscape. A total single-tree selection regeneration strategy may eliminate some early successional bird species from the landscape. The major effects on biodiversity will be in abundance and distributions of species and individuals. There will be differences in cumulative effects by alternative, with differences caused primarily by rotation length, patch size, and residual basal area.

Cumulative effects are the additive result of a series of direct and indirect effects, plus the effects of foreseeable future actions including those occurring on adjacent lands. As such, the disclosure of direct and indirect effects at the landscape level are part of the cumulative effects analysis. The following disclosure by alternative is supplemental information to the direct and indirect effects.

Cumulative effects of regeneration at a landscape scale can be analyzed in two ways. One way is to analyze the effect of harvesting, scattered across the landscape, through time. This is where the major effects will occur. These effects are disclosed in the following discussion. The other analysis would look at the repeated harvest of individual stands scattered across the landscape. The affects under this scenario would be similar to those disclosed under cumulative effects at the stand level. However, effects that may be significant at the stand level, could be insignificant at the landscape level.

Alternative A: In Alternative A, management areas are 3/4-mile radius circles around active and inactive clusters. Within these circles a 120-year rotation would be implemented for all pine types. This would result in 8.3 percent of the area in seedlings and saplings, approximately 17 percent in large saplings to large poles (3-10 inches), and about 75 percent of the circle with a continuous canopy of trees greater than 10 inches diameter. The oldest 1/3 of suitable habitat is not planned for regeneration until near rotation, clearcuts must average less than 25 acres, and irregular shelterwood regeneration areas have an 80-acre maximum patch size with no removal of seed trees. With these conditions, fragmentation should not be an issue. Two distinct situations could develop at the landscape level, depending on existing population densities.

In dense RCW populations with overlapping 3/4-mile radius circles, the landscape should have habitat conditions approaching the percentages stated above. The landscape would be dominated by mature pines with scattered pockets of early and mid-successional habitats. These conditions should be beneficial to bird species that have minimum tract size requirements such as yellow-throated warbler, pileated woodpecker, and summer tanager (Hamel 1992). Early successional bird species may see declines in abundance from current levels, on National Forest lands under this strategy, but not to the point where viability becomes a concern. Population declines would be caused by a smaller percentage of the landscape in early successional habitats. Any interspersed private or corporate forest lands within the circles would probably be managed on a shorter rotation (USDA Forest Service 1988) which would benefit early successional species.

Thompson et al. (1992) stated in extensively forested areas, early successional bird species had the most limited distributions. This would appear to be true in Alternative A, where only 8.3 percent of the area would be in early successional habitats. However, one must consider that regionally, only about 6 percent of the commercial forest lands in the Southeast are National Forest System lands (Young and Mustian 1989). With the likelihood of shorter rotations on private and corporate lands, the longer rotations in this alternative may be providing a relatively unique resource-larger, older, trees. These larger, older trees are important for many cavity dependent species. Without the longer rotations, there could be adverse cumulative effects on cavity dependent species at the landscape level. The increased acreage in older trees may result in population increases of late successional species.

Irregular shelterwood and uneven-aged regeneration systems would predominate. Wood and Niles (1978) stated shelterwood regeneration methods have minimal impact on bird populations and the degree of impact depends upon the amount of residual overstory left standing and the length of time before residuals are removed. Myers and Johnson (1978) stated the presence of overstory trees during the early stages of succession encourages forest, field, and shrubland breeding birds. Natural mortality of residual trees would provide large snags for snag dependent species. Hall (1987) studied avian use of regeneration areas in east Texas and found greater bird species diversity and abundance in seed-tree cuts compared to clearcuts. Based on this, irregular shelterwood methods should provide for higher avian diversity per unit area and more complex bird communities.

Implementation of single-tree selection on all National Forest lands across the entire landscape, may affect certain early successional bird species within the planning area. Two species that could be affected are prairie warbler and painted bunting. Single-tree selection may not create suitable size patches for these species. It is unlikely these species would be eliminated from the landscape however, because of the probability of suitable habitat existing on adjacent private lands.

The key factor affecting plant and animal distributions will be the landscape mozaic created by the regenerated patches. With balanced age and/or size classes, there should be a relatively constant flow of habitats through time. Plant and animal communities are dynamic and are in a constant state of flux, to take advantage of habitat conditions as they develop within the landscape. Although communities are dynamic, the balanced flow of habitats through time should result in relatively stable populations within the landscape.

The second situation that could occur at the landscape level under Alternative A, would develop in sparse RCW populations where 3/4-mile radius circles were demographically isolated from one another. Within 3/4-mile radius circles, 8.3 percent of the area would be in early successional habitat, approximately 17 percent in large saplings to large poles (3-10 inches diameter), and about 75 percent of the circle would be in continuous canopy cover of trees greater than 10 inches diameter.

Outside of 3/4-mile circles, the landscape would likely have the pine types managed on a 70-year rotation or less, the situation that has existed over the last 10 years. This would result in a landscape outside the circles composed of at least 14.3 percent seedling and saplings, at least 28.6 percent in large saplings to large poles (3-10 inches diameter), and no more than 57 percent in continuous canopy of trees greater than 10 inches diameter. Superimposed on this landscape would be the demographically isolated 3/4-mile circles. The unique feature of the circles would be the presence of trees older than 70 years. These patches of older trees may be contiguous within a 3/4-mile circle, but would be demographically isolated "islands" of older trees at the landscape level.

The effects of a landscape pattern such as this on biodiversity are varied. The likely short rotations outside of 3/4-mile radius circles, the regeneration of interstitial spaces (area between nonoverlapping 3/4-mile radius circles), and the probable shorter rotations on adjacent private and corporate lands could lead to habitat fragmentation. Populations of various species that are sensitive to fragmentation may become isolated from one another, and populations may decline.

Species that are habitat generalists or associated with early successional habitats should benefit from the high degree of regeneration activity. These species should have increases in both densities and distributions at the expense of habitat specialists. As habitats get more fragmented, populations become more isolated on smaller habitat patches, become more prone to severe demographic stochasticity and are more susceptible to extinction (Wilcox and Murphy 1985, Gilpin and Soule 1986).

The major game species (deer, turkey, and quail) should benefit from the increase in available food and cover associated with all the regeneration. There could be increases in population densities and there should be changes in home ranges and territories to utilize available habitats. Changes in home ranges and territories may influence the distribution of plant species. Plant species whose seeds are distributed by clinging to animals or by passing through an animal's digestive tract, may see increases in distributions when compared to Alternatives C and E, which have smaller patch sizes and large HMAs.

Alternative B: Alternative B does not implement an HMA concept. RCW management consists of protecting the clusters, replacement stands, and recruitment stands and providing enough foraging habitat for active clusters and recruitment stands. Foraging requirements that must be met include providing 8,490 square feet of pine basal area, providing 6,350 pine stems at least 10 inches in diameter and at least 30 years old, and this habitat must be within 1/2 mile of the cluster and not be isolated. This generally takes about 125 acres depending on pine stocking in the stands. Rotation ages are 80 years for longleaf pine and 70 years for all other southern yellow pine species. Maximum regeneration patch size is 80 acres. This would result in a landscape with approximately 12.5 percent - 14.3 percent in seedlings and saplings, 25 percent - 28.6 percent in large saplings to large poles (3-10 inches diameter), and 57 percent - 63 percent with a continuous canopy of trees greater than 10 inches in diameter. Relict trees or the oldest 1/3 of suitable habitat are not protected. Two distinct situations could develop at the landscape scale, depending on existing population densities.

In very dense RCW populations with overlapping foraging habitats, the RCW guidelines would be protecting, through time, the habitat for species sensitive to fragmentation or dependent on mature and overmature trees. Regeneration would not be able to occur until additional foraging habitat developed from existing stands in the 0-30 age classes, or until some clusters were lost. This could result in stands growing well beyond rotation, benefitting many species including cavity nesters.

Early successional plant and animal species would likely have declines in densities and distribution on National Forest lands. Adjacent private and corporate forest lands would likely provide abundant early successional habitat (USDA Forest Service 1988). Currently, only the Francis Marion, Apalachicola, and Vernon populations are large enough and dense enough to create a landscape similar to that just described.

The most common situation occurring at the landscape level is where RCW populations are sparse, with clusters isolated from one another. Foraging habitat is dynamic and as stands grow into foraging condition, older foraging stands could be regenerated as they reach rotation age. This would result in a landscape similar to that described above in regard to percentage of seedlings and saplings, poles, and mature trees. Superimposed on this landscape would be the demographically isolated clusters consisting of stands of trees older than 80 years and approximately 10 acres in size. The clusters themselves would likely be the only habitat greater than 80 years old in the landscape.

The cumulative effects at the landscape level should be similar to those disclosed for alternative A, except the severity of effects should be greater, particularly around clusters. In alternative A, there would be approximately 380 acres of habitat greater than 80 years old in the vicinity of a cluster. This compares to approximately 20 acres of habitat older than 80 years around a cluster in Alternative B. The small acreage in older, larger trees in alternative B may increase competition from other cavity nesters, for RCW cavities. The potential for fragmentation is much greater around clusters in Alternative B.

Alternative B would likely rely most heavily on seed-tree and shelterwood regeneration methods as compared to irregular shelterwood in Alternative A. This would affect bird communities utilizing regeneration areas. The 70-80 year rotation in this alternative, combined with a high probability of shorter rotations on adjoining private and industrial lands, should be beneficial to early successional species such as indigo bunting and most game species. There will be abundant brushy cover and excellent production of browse and forage. Late successional species, forest interior species, and species dependent on large trees and snags, may be adversely affected by the short rotation, percentage of acres in 0-30 year age classes, and removal of all overwood.

Without any overwood retained, the regenerated areas would be similar to clearcuts and would only support early successional bird species during early stand development. With no retention of overwood, cavity and snag dependent species would likely be eliminated from regenerated areas for at least 40 years, the minimum length of time it would likely take to grow suitable sized cavity trees for the smaller cavity and snag dependent species.

It would take longer to grow suitable sized trees for larger cavity nesters such as pileated woodpecker, screech owl, and American kestrel. In a fire dependent ecosystem with trees managed on a 70-80 year rotation, cavity and snag dependent species may be eliminated from or have populations drastically reduced in 50 percent of the landscape at any point in time.

Implementation of seed-tree and shelterwood regeneration strategies may affect distribution and abundance of certain plants. Species requiring shade to partial shade for growth and development, may be eliminated from recently regenerated stands. Conversely, species needing full sun should thrive. These stand level responses will affect distributions and abundance at the landscape level.

Alternative C: This alternative implements an HMA system with a minimum size of 6,150 acres, and establishes management intensity levels based on population size. In Alternative C, patch size and regeneration strategies vary by MIL. In MILs 4 and 5, regeneration is primarily accomplished with irregular shelterwood methods and patch size should average 25 acres or less. In MILs 1, 2, and 3, patch size is governed by Forest Plan guidelines and can be as large as 80 acres. Seed-tree and shelterwood regeneration methods can occur in MIL 1, but irregular shelterwood methods must be used in MILs 2 and 3. Uneven-aged regeneration methods can be used in all MILs. Clearcutting can occur in very specific situations. Because clearcutting is so limited, there should not be cumulative effects from clearcutting. Rotation is based on forest type and site index, with loblolly/slash pine rotations ranging from 100 years (poor site) to 120 years (good site). Longleaf/shortleaf pines would be on rotations ranging from 120 years (poor site) to 200 years (good site). At the landscape level, this would result in 5 percent - 10 percent in seedlings/saplings, 10 percent - 20 percent in large saplings to large poles (3-10 inches diameter), and approximately 70 percent - 85 percent of the area with a continuous canopy of trees greater than 10 inches in diameter. Variation in percentages of each broad habitat type occur because of heterogeneity of forest types and variation in site quality across the landscape.

Cumulative effects, by definition, occur over a period of time. Any given RCW population could grow through different MILs during the period of cumulative effects analysis. Cumulative effects are not affected by MIL designation, but are affected by rotation length, patch size, and residual basal area.

In general, implementing this alternative should have negligible cumulative effects on biological diversity. Habitat Management Area designations and long rotations should preclude adverse cumulative effects on forest interior species, late successional species, and species needing large trees and snags. Any retention of trees in regeneration areas would provide habitat for species needing large trees and canopies for food and cover. These could also be potential cavity trees for the RCW and future snags benefitting snag dependent species. Early successional bird species may be adversely affected (lower densities) by the decrease in suitable habitat caused by limited regeneration.

The regeneration areas will provide habitat for early successional bird species that otherwise would not have existed. Thompson et al. (1992) pointed out that in extensively forested areas, it is the early successional species such as prairie warbler and yellow-breasted chat that are often limited by lack of suitable habitat. The likelihood of shorter rotations outside of HMAs and on adjacent lands should provide excellent habitat through time for species dependent on younger age classes. Within HMAs, lower densities of early successional species should be expected, but there should not be a problem with viability.

The major game species (deer, turkey, and quail) may be minimally impacted by the long rotations. Site preparation burning and increased sunlight reaching the forest floor should produce more food and cover than uncut stands, but this alternative will produce less food and cover than other alternatives because of the longer rotations. This could affect densities and distribution of game species. Deer and turkey may not use the interior of larger patches allowed in MILs 1, 2, and 3.

The effects of implementing an uneven-aged management strategy are quite varied. Most bird species should benefit from an uneven-aged silvicultural system. Yahner (1986) found no negative impacts on birds of small (less than 2.47 acres) clearcuts, which would be similar to group selection harvest. The importance of foliage height diversity to birds has been discussed previously (McArthur and McArthur, 1961; Willson 1974; Knoodsma, 1984). Uneven-aged systems should provide the greatest foliage height diversity. These systems will also provide some large trees and snags throughout the area benefitting snag dependent species. Early successional species may be present at low densities because of limited habitat. A total single-tree selection strategy may eliminate some early successional species from the landscape because of lack of suitable size habitat patches.

Game species are not likely to benefit from uneven-aged management systems. Blair (1969) stated forage and fruit production for deer on forest lands is inversely related to timber stand density, the higher the stem density, the less forage produced. Murphy and Crawford (1970) stated production of deer and turkey foods were low in most forest types managed under uneven-aged systems because of dense overstories. The dense overstories will compete with food production as well as regeneration. The foliage height diversity present in stands managed under uneven-aged systems may inhibit the vision of species like wild turkey which rely heavily on eye sight for protection.

To get regeneration established, burning regimes may need to be altered. This alternative may adversely affect the quantity and quality of forage and browse produced. The lower production of food may lead to lower densities of game species throughout the area.

The cumulative effects on plant communities, abundance, and distribution should be similar to those disclosed in Alternative A and in the discussion on indirect effects at the landscape scale.

Alternative D: In Alternative D, regeneration cutting can only occur for restoration of sites that have previously gone through a forest type conversion. The forest type conversion could have occurred from natural seeding in after a stand was harvested in the past, or it could have been caused by management through site preparation and planting. All regeneration methods will be allowed. Because there is no plan for sustained yield of RCW habitat in this alternative, rotations are not established. For planning purposes, restoration should occur at a rate equivalent to a 100-year rotation (10% in the 0 -10 year age class). This should preclude age class bulges which could affect RCW habitat in the future, and it should avoid potential cumulative effects on biodiversity. Because all acres will not need restoration and there is no plan for sustained yield, any cumulative effects should be insignificant.

Alternative E: This alternative implements an HMA system with a minimum size of 6,150 acres, and establishes management intensity levels based on population size and trend. In Alternative E, patch size and regeneration strategies vary by MIL. In MILs 3 and 4, regeneration is primarily accomplished with irregular shelterwood methods and patch size must be 25 acres or less. In MILs 1, and 2, there is a 40 acre maximum regeneration patch size. Seed-tree and shelterwood regeneration methods can occur in MIL 1, but shelterwood method with reserve trees must be used in MIL 2. Uneven-aged regeneration methods can be used in all MILs. Clearcutting can occur in very specific situations. Because the situations are so limited, there should not be any cumulative effects of clearcutting.

Rotation is based on forest type, with a loblolly/slash pine rotation of 100 years and longleaf/shortleaf pines on a rotation of 120 years. In situations where historical records indicate a high probability of catastrophic southern pine beetle outbreaks affecting loblolly or shortleaf pine, or soils information indicates a low probability of loblolly pine stands living to 100 years, an 80-year rotation for loblolly or shortleaf pine can be implemented. If the 80-year rotation option is implemented regeneration will be with irregular shelterwood methods and shelterwood trees will be left in perpetuity. Virginia pine will be managed on a 70-year rotation. Virginia pine makes up only a minute portion of the RCW habitat regionally and as such any cumulative effects would be insignificant.

At the landscape level, the above rotations would result in 8.3% - 12.5% in seedlings/saplings, 16.6% - 25% in large saplings to large poles (3-10 inches diameter), and approximately 63% - 75% of the area with a continuous canopy of trees greater than 10 inches in diameter. Variation in percentages of each broad habitat type occur because of heterogeneity of forest types and variation in site quality across the landscape. It is highly unlikely the cumulative affects on a landscape will ever have 12.5 percent in seedlings and saplings or as little as 63 percent in trees greater than 10 inches in diameter. For these conditions to exist, the entire landscape would have to be composed of high risk loblolly or shortleaf pine. Currently, a great deal of the high risk loblolly pine is the result of past forest type conversions. Restoration of these stands will preclude managing them on an 80-year rotation.

The cumulative effects of implementing Alternative E on biological diversity should be very similar to the effects disclosed for Alternative C. Alternative E may produce higher densities of early successional bird species when compared to C because of the greater availability of suitable habitat, but densities may be lower than existing levels. Alternative E should produce greater amounts of food and cover for game species, particularly where the 80-year high risk rotation is implemented, but lower than existing levels. The small patch sizes should not preclude deer and turkey use of the interior of regeneration units. With the 80-year option for loblolly or shortleaf, overwood is retained in perpetuity. This will provide mature trees on every acre and should preclude the effects of fragmentation. The overwood will also provide potential future RCW cavity trees and potential large snags for snag dependent species. In general, the differences between Alternatives C and E should be inconsequential in regard to effects on biodiversity, at the landscape level.

PINE RESTORATION

This activity pertains to the restoration of sites that have previously gone through a forest type conversion. The forest type conversion could have occurred from natural seeding in after a stand was harvested in the past, or it could have been caused by management through site preparation and planting. Before restoration can occur, the forest cover needs to be removed from the site. This can be accomplished by harvesting the trees if they are large enough, or if the trees are small enough and are slash or loblolly pine, prescribed fire may be effective to prepare the site. Pine restoration is normally accomplished by clearcutting and as such, the direct, indirect, and cumulative effects will be very similar to those disclosed under regeneration.

All alternatives allow for pine restoration, but in Alternatives C, D, and E pine restoration is a critical component of the strategy. There should be beneficial cumulative effects from pine restoration. The landscape will begin to be more representative of the ecosystems that existed historically in regard to forest cover. The more natural landscape should help alleviate some of the current problems with insects and disease outbreaks, resulting in a healthier ecosystem. The more natural landscape may also develop better fuel conditions to help achieve effective growing season prescribed burns, ultimately resulting in positive affects on biological diversity.

PHYSICAL

The following discussion pertains to the physical components of the environment which may be affected by the proposed action and alternatives.

Air

PAST CONDITIONS THAT HAVE AFFECTED THE PRESENT CONDITION

The southern yellow pine ecosystems evolved with fire. These ecosystems are dependent on periodic fires for their continued existence. Air quality of the region has been subject to the influence of wildland fires for thousands of years. In the past 200 to 300 years, the Southeast has been settled, gone through periods of population growth, and seen industrialization in some of the major cities. All of these activities have affected air quality of the region.

PRESENT CONDITION OF AIR QUALITY

In the dormant season, air flow and quality are dominated by migrating, frequently changing air masses and storm systems. In the growing season, air flow and quality are dominated by the Atlantic high pressure system whose clockwise movement pumps in tropical air from the Gulf of Mexico. Prevailing winds in all seasons are from the southwest.

Air quality is generally good in winter and spring when rapidly changing weather patterns tend to keep the atmosphere well mixed. Occasional stagnation periods in summer and fall cause natural and manmade pollutants to concentrate. No major industrial centers occur in the area of the National Forests, but pollutants emanate from local sources, including cities. Some National Forests have industrial facilities near the forest boundary, and the aromas from the facilities can be detected under certain weather conditions. Pollutants may also be transported into the region from long distances.

SCOPE OF ANALYSIS

This analysis focuses on the effects of the proposed action and the various alternatives on air quality. This analysis will only discuss prescribed burning, as it is the only aspect of any of the alternatives that could potentially affect air quality. Because there are so many site-specific factors that could affect air quality, a regional analysis must be kept general to draw meaningful comparisons between alternatives. The following effects analysis is based on acres burned annually and season of burn. In general, growing season burns produce more smoke and particulate matter than dormant season burns. Site-specific factors will be used to determine effects at the individual project level.

DISCLOSURE OF EFFECTS

The kind of effects of prescribed burning on air quality are the same for all alternatives. The degree of effect does vary by alternative and is influenced by acres burned, season of burn, and numerous site-specific factors including fuel type, moisture content, amount and arrangement of fuel, air temperature, wind speed and direction, transport wind speed, and mixing height.

Direct Effects

The most common direct effects of prescribed burning are visibility reduction and respiratory impairment near the fire. These effects usually last only for the duration of the burn and are caused primarily by increased airborne particulates. Prescribed burning plans include mitigation measures to minimize these effects. It is especially important to be aware of potential effects near roads, airports, and populated areas.

In Alternative B, approximately 31,130 acres would be prescribed burned annually for RCW, primarily during the dormant season. Alternative B would have the least affect on air quality. Alternatives C, D, and E propose prescribed burning approximately 487,500 acres annually for RCW. Alternatives C and D emphasize growing season burning, while E has an emphasis on growing season burning but realizes burning will occur year round. Any difference in these three alternatives should be insignificant. These alternatives have the greatest potential to affect air quality. Alternative A proposes treating approximately 362,500 acres annually with an emphasis on growing season burns. The effects of Alternative A would be more similar to C, D, and E than Alternative B.

Indirect Effects

Indirect effects of prescribed burning are usually the impairment of general air quality in areas downwind from the burn site. As with direct effects, mitigation measures are included in burning plans to minimize these effects. Indirect effects can be intensified by inversions or at night when rising humidity can cause a smoke-fog mixture to form. As with direct effects, Alternative B has the least potential for effects, while Alternatives C, D, and E have the greatest potential for effects.

Cumulative Effects

Less than four percent of National Forest System lands in the Southeast will be prescribed burned annually for RCW, even with the maximum RCW prescribed burning program (487,500 acres annually). National Forest System lands comprise slightly more than five percent of the commercial forest land in the South (Young and Mustain 1989). The maximum RCW burning program would represent less than 0.25% of forested lands in the South being burned annually.

For a more detailed discussion of the effects of prescribed burning on air quality, see Final Environmental Impact Statement Vegetation Management (FEIS VEG MGMT) in the Coastal Plain/Piedmont, pages IV-106 to IV-113; FEIS VEG MGMT in the Appalachian Mountains, pages IV-122 to IV-128; and FEIS VEG MGMT in the Ozark/Ouachita Mountains, pages IV-116 to IV-123. The material referenced above is incorporated by reference in accordance with 40 CFR 1502.21. The environmental impact statements referenced above can be reviewed at Forest Service Ranger District and Forest Supervisor offices throughout the South.

Minerals and Energy Resources

PAST ACTIONS THAT HAVE AFFECTED THE PRESENT CONDITION

Minerals are divided into three classes for management purposes: locatable, salable, and leasable minerals. The manner in which each is managed and the authority of the Forest Service to control the exploration for and development of each management class varies considerably.

Locatable Minerals - These are those metallic and nonmetallic minerals for which the 1872 mining law gives U.S. citizens the statutory right to prospect for, locate, and develop claims on public domain lands. Gold, silver, copper, and zinc are examples of minerals which are generally locatable. However, a very small percentage of National Forests in the Southern Region were in public domain. Therefore, this type of mineral exploration and development is insignificant on the 11 National Forests occupied by the red-cockaded woodpecker (RCW).

Salable Minerals - These are common varieties of sand, stone, gravel, clay, etc. In general, these minerals are of widespread occurrence, of relatively low unit value, and are generally used for construction materials or for road building purposes. Disposal of salable minerals from public lands administered by the Forest Service is totally at the discretion of the Forest Service (see regulations at 36 CFR 228, Subpart C).

Leasable Minerals and Energy Resources - These include those minerals, including oil and gas, that can be leased under one of several mineral leasing acts (Mineral Leasing Act, 1920; Mineral Leasing Act for Acquired Lands, 1947; Federal Onshore Oil and Gas Leasing Reform Act, 1987). The predominate leasable minerals on the eleven RCW National Forests are oil, gas, and coal.

PRESENT CONDITION OF MINERAL RESOURCES

At present, 3.5 million acres (27%) of the Southern Region is leased for some type of mineral exploration or development. In addition, the mineral rights on 2.3 million acres (18%) are reserved or outstanding, i.e., the mineral rights are controlled or owned by someone other than the U.S. Government. Of the 11 RCW Forests, five have a significant acreage under lease. They are: National Forests in Alabama, 37 percent; Kisatchie National Forest, 50 percent; National Forests in Mississippi, 68 percent; Ouachita National Forest, 47 percent; and National Forests in Texas, 68 percent.

Collection of firewood from National Forests occupied by RCW peaked in the early 1980s, coinciding with the oil shortage. Demand has since steadily declined as the availability and cost of other fuels have improved.

SCOPE OF THE ANALYSIS

This analysis focuses on the effects of the proposed action and the various alternatives on mineral resources. The following section discloses the expected effects the proposed action and alternatives should have on mineral resources, if implemented. The disclosure of effects applies to areas where the minerals are in federal ownership. Where mineral rights are not federally owned, site-specific effects will depend on opportunities for mitigation and the willingness for individual mineral owners to work cooperatively with the Forest Service.

DISCLOSURE OF EFFECTS

There are two aspects of RCW protection and management which could potentially conflict with exploration for or development of minerals and energy resources. They are: criteria to protect clusters, replacement, and recruitment stands, which prohibit certain activities within these areas, and limitations on clearings for nonsilvicultural purposes within 1/4 mile of clusters. Following is a discussion of these RCW protection/management activities on minerals and energy resource development.

CLUSTER, REPLACEMENT, AND RECRUITMENT STAND PROTECTION

Direct Effects

Alternative B could allow such activities to occur within clusters if the activities occurred outside the nesting season and cavity trees were adequately protected. The only direct effect under this alternative could be a delay in the timing of the activity to avoid the RCW nesting season. Alternatives A, C, D, and E all prohibit surface occupancy within clusters at any time. Alternative A would prohibit surface occupancy for exploration or development on 124,520 acres, while Alternatives C, D, and E have prohibitions on 156,720 acres. Alternative B has no prohibitions as long as cavity trees are protected and there are no adverse affects on RCW. All permits issued by the Forest Service allowing mineral/energy resource exploration/development contain a clause providing mitigation to protect threatened or endangered species.

Indirect and Cumulative Effects

Under Alternative B, delaying an activity to avoid the RCW nesting season could inconvenience a permittee or possibly create and excessive financial burden. The total prohibition of surface occupancy in clusters under Alternatives A, C, D, and E would require permittees to relocate exploration/development activities or access roads outside clusters. This could result in increased cost to the permittee, especially if directional drilling for gas/oil was necessitated by the move.

Potential conflicts are greater in situations where the mineral rights beneath Forest Service lands are outstanding, i.e., belong to someone other than the U.S. Government. In such cases, if the permittee feels the required mitigation is excessive, they could charge the Forest Service with "take" of their right to develop their resource. The Forest Service could then be forced to either relax the required mitigation or purchase the permittee's mineral rights. These conflicts are normally resolved through the courts.

CLEARING FOR MINERAL EXPLORATION AND DEVELOPMENT

All alternatives allow clearing for mineral exploration and development. Protective measures vary by alternative. The intent of the restrictions on clearing are to minimize the affects of fragmentation and to ensure adequate foraging habitat is available. Most clearings for oil and gas well sites in the Southern Region are one acre or less in size. The following discussion deals with suitable RCW habitat, but not clusters, recruitment, or replacement stands. This discussion is only pertinent to areas where minerals are in federal ownership. In areas with reserved or outstanding mineral rights, individual Forests should work with the mineral owner to try and mitigate adverse effects. If mitigation is not possible or acceptable, the Forest Service may need to purchase the mineral rights.

Direct, Indirect, and Cumulative Effects

Prohibiting development would have economic impacts on permittees as well as economic losses to the federal government through lost royalties. As habitat conditions change, exploration and development may become possible. This would still cause economic losses to permittees and the government, but not to the extent that would occur if development were prohibited.

Alternative A: Within 1/4 mile of clusters, clearings of 10 acres or less could occur if no more than 8.5 percent of suitable habitat within 1/4 mile is less than 10 years old and no more than 25 percent of suitable habitat is less than 30 years old. Clearings of more than 10 acres are prohibited within 1/4 mile of clusters. Between 1/4 and 3/4 mile of clusters, clearings could occur but not in the oldest 1/3 of suitable habitat. Clearings larger than 10 acres must not create habitat fragmentation, or adversely affect foraging availability, or age class distributions.

Alternative B: The only restriction on exploration and development is that the RCW should not be adversely affected. Development of oil and gas resources in suitable habitat outside of clusters, replacement, and recruitment stands should not adversely affect RCW because small acreages are involved. Mining of coal and salable minerals (sand, gravel, clay, etc.) could affect large acreages and therefore may have adverse affects on RCW.

In areas where adverse effects are not predicted to occur, mineral exploration and development could occur. Direct, indirect, and cumulative effects on mineral resources would not be expected. In areas where adverse effects to RCW are predicted, direct, indirect, and cumulative effects would be the same as those describe for Alternative A.

Alternatives C, D, and E: Clearing for mineral exploration and development is allowed, but the overall capability of an HMA to meet its population objective should not be reduced. The assessment of effects of proposed clearing on an HMA's capability to support RCW should address foraging habitat availability and continuity, and cluster and recruitment stand isolation. Alternatives C and D prohibit permanent clearing, removal, or loss of habitat within 1/4 mile of groups and recruitment stands in MILs 4 and 5. Alternative E prohibits permanent clearing within 1/4 mile of groups in MILs 3 and 4.

In areas where adverse effects are not predicted to occur, mineral exploration and development could occur. Direct, indirect, and cumulative effects on mineral resources would not be expected. In areas where adverse effects to RCW are predicted or where clearing is prohibited, direct, indirect, and cumulative effects would be the same as those describe for Alternative A.

All 11 forests covered by this EIS allow for mineral exploration and development with some restrictions for RCW. Alternative A would allow development with RCW restrictions on 1.45 million acres, with an additional 6.17 million acres potentially available without RCW restrictions. Alternative B would allow development with RCW restrictions on 1.06 million acres, with an additional 6.56 million acres potentially available without RCW restrictions. Alternatives C, D, and E would allow development with RCW restrictions on 1.95 million acres, with an additional 5.67 million acres potentially available without RCW restrictions.

In all alternatives where RCW management and mineral development is compatible, there could be direct, indirect, and cumulative economic effects. If Federal minerals are developed, permittees and the Federal government will benefit economically.

Wilderness

PAST ACTIONS THAT HAVE AFFECTED THE PRESENT CONDITION

Since the passage of the Wilderness Act in 1964, 76 wildernesses totaling more than 700,000 acres have been designated on National Forest System lands in the Southeast. Of these wildernesses, 30 have forest types that could potentially be suitable for RCW and occur within the range of the RCW. Eleven of the 30 wildernesses have evidence of past RCW use, and only four wildernesses currently contain active RCW clusters.

Wildernesses occurring within the range of the RCW vary in size and include bays, swamps, hardwood river bottoms, pine flatwoods, rolling pine uplands, and pine and pine-hardwood mountain forests. These areas have a wide variety of plants and animals, many of which are threatened, endangered, or sensitive.

Since designation, the wildernesses have generally not had vegetation management activities occurring in them. Wildfires were generally controlled as quickly as possible, and prescribed fire was rarely used as a management tool. Thinnings are not allowed in wilderness, and this has led to the development of older pine stands with relatively high basal areas. In loblolly and shortleaf pine forest types, this has resulted in increased southern pine beetle activity. All Forest Service wildernesses in Texas and Louisiana have had past southern pine beetle infestations. Little Lake Creek and Kisatchie Hills wildernesses have had drastic changes in wilderness characteristics caused by southern pine beetle infestations and control efforts.

PRESENT CONDITION OF WILDERNESS

The southern yellow pine ecosystems evolved with fire. Most fires occurred during the growing season. This fire regime developed unique plant communities across the Southeast. Fire control and limited prescribed burning in wilderness has resulted in changes in plant community composition. Currently, many wildernesses are changing in regard to vegetation composition and structure. Without reintroduction of fire into wildernesses, some of the characteristics which led to their establishment as wilderness, may be lost.

Past fire control and wilderness protection instead of management has resulted in most wildernesses developing a dense hardwood and pine midstory. The midstory conditions have made most wildernesses unsuitable for RCW. In 1993, there were approximately 25 active clusters located in only five wildernesses. These areas are: Little Lake Creek and Upland Island in Texas, Kisatchie Hills in Louisiana, and Mud Swamp/New River and Bradwell Bay, both in Florida. Kisatchie Hills, Mud Swamp/New River, and Bradwell Bay all have a longleaf pine component and this is where the RCW occur. Little Lake Creek is dominated by loblolly pine, is continually going through southern pine beetle attack, and will likely become unsuitable for RCW.

All Forest Service wildernesses in Texas and Louisiana have had active southern pine beetle infestations occurring in them during the last last two years. This beetle activity plus past activity and control efforts has resulted in the regeneration of a few thousand acres of wilderness. These areas are developing into young pine and pine/hardwood forests. Without periodic fires, these areas will not be suitable for RCW in the future.

SCOPE OF THE ANALYSIS

This analysis focuses on the expected direct, indirect, and cumulative effects the proposed action and alternatives should have on wilderness resources, if implemented. The disclosure of effects will be limited to the affects of southern pine beetle control in wilderness to protect RCW.

DISCLOSURE OF EFFECTS

There are active and inactive RCW clusters located within National Forest designated wildernesses. The U.S. Fish and Wildlife Service during consultation on the Environmental Impact Statement for the Suppression of the Southern Pine Beetle, declared some wilderness RCW groups essential to the recovery of the species (USDA Forest Service 1987 page 4-36). Alternatives A, B, C, and D will consider wilderness RCW groups as essential. Alternative E will consider wilderness RCW groups as non-essential to recovery. This determination is based on new technology (artificial cavities and translocation) developed since 1987 and the fact all recovery populations can meet their recovery objectives without wilderness acres. All support populations can maintain short term viability (100's of years) without wilderness acres.

In Alternative E, wilderness RCW groups should be managed, not because they are essential to recovery or needed to maintain viability, but because of obligations under the Endangered Species Act. If an individual Forest chooses not to manage its wilderness groups, that Forest must go through formal consultation with the U.S. Fish and Wildlife Service and must obtain an incidental take statement.

SOUTHERN PINE BEETLE CONTROL

Alternatives A, B, C, and D consider wilderness RCW groups essential to recovery. As such, southern pine beetle control will occur in wildernesses to protect these groups as discussed in the Final Environmental Impact Statement for the Suppression of the Southern Pine Beetle, following the criteria established in the Record of Decision for that document (USDA Forest Service 1987). The Record of Decision stated only essential groups and their foraging habitat would be protected. The criteria that triggers initiation of control action are the southern pine beetle infestation must be within 1/2 mile of an essential group, adverse effects are likely to occur within the next 30 days, and the continued existence of the group is in question.

Direct Effects

Implementing control action to protect RCW habitat would result in trees being cut. In some cases, large acreages could be cut to control southern pine beetle.

Cutting trees will directly affect natural integrity, apparent naturalness, scenic values, and opportunities for primitive recreation and solitude.

Indirect and Cumulative Effects

The changes in natural integrity, apparent naturalness, scenic values, and opportunities for primitive recreation and solitude would likely result in decreased use of the area by wilderness enthusiasts. The changes in habitat conditions may lead to increased use of wildernesses by hunters in pursuit of deer, which may be influenced by increased amounts of food and cover.

For a more detailed description of potential affects of southern pine beetle control on wilderness please see pages 4-30 to 4-34 of the Final Environmental Impact Statement for the Suppression of the Southern Pine Beetle, Southern Region (USDA Forest Service 1987). The above cited material is incorporated by reference in accordance with 40 CFR 1502.21.

Alternative E: Wilderness RCW groups are considered non-essential and southern pine beetle control would not be initiated to protect wilderness RCW groups or their foraging habitat. However, southern pine beetle control could be initiated within wilderness to protect RCW groups or their foraging habitat if they are immediately adjacent (within 1/4 mile) to the wilderness boundary. Foraging habitat that occurs in wilderness will not be protected.

Before control is initiated within wilderness to protect groups and foraging habitat outside of wilderness, the criteria established for protecting adjacent state and private lands in the Record of Decision for the Final Environmental Impact Statement for Suppression of the Southern Pine Beetle must be met (USDA Forest Service 1987 Record of Decision pages 32-33). The infestation must occur within 1/4 mile of a RCW group or its foraging habitat, and must be predicted to spread to the susceptible habitat and cause unacceptable damage to the habitat before control action will be considered.

For example, if the closest foraging habitat is 1/4 mile from the wilderness boundary and an infestation is predicted to leave wilderness, control within wilderness would not likely be justified. There should be enough area outside of wilderness to effectively control spot growth. However, if a group or foraging habitat occurred across a road from wilderness, control within the wilderness would be justified. Southern pine beetle control to protect RCW and its habitat will only occur within wilderness if site-specific analysis indicates a reasonable expectation of successful control and protection could not occur outside of wilderness.

Where control actions are taken, the direct, indirect, and cumulative effects of Alternative E should be similar to the effects disclosed for Alternatives A, B, C, and D. The severity and magnitude of effects should be considerably less for Alternative E because control actions are initiated in wilderness only as a last resort, and only within 1/4 mile of the wilderness boundary. This will allow natural processes to occur within the core of wildernesses.

In areas where control actions are not initiated, the expected effects are as follows:

Direct Effects

No control of southern pine beetle infestations to protect RCW habitat will result in pine trees being killed. Because natural processes are allowed to function, there should be no affect on natural integrity, apparent naturalness, or opportunities for primitive recreation and solitude. Scenic values will be affected because of large amounts of dead trees.

Indirect and Cumulative Effects

There should be no indirect or cumulative affects on natural integrity, apparent naturalness, or opportunities for primitive recreation and solitude. Although opportunities for primitive recreation and solitude are not affected, actual use of a given wilderness will likely decrease as scenic values continually decrease. The decrease in scenic value is caused by increasing acreage in dead trees.

No control action will likely result in all RCW groups moving out of wildernesses affected by southern pine beetle because of loss of habitat. In wildernesses with older trees, high basal areas, and more susceptible pine species (loblolly and shortleaf), one could anticipate most older trees will eventually be killed whether control action is taken or not.

Recreation Opportunities

Forest recreationists have different expectations from their experiences. Some people value the very existence of the forests and need not visit any forest to derive satisfaction. Others regularly use the forests, with experiences ranging from those associated with highly developed sites to wilderness experiences.

PAST ACTIONS THAT HAVE AFFECTED THE PRESENT CONDITION

The primary action that has affected current recreational opportunities was the establishment of the Southern National Forests and the natural regrowth of vegetation. Another major factor was the development of several flood control reservoirs across the Southeast. These reservoirs provided opportunities for water-based recreation and additional opportunities for developed recreation sites. As the human population of the Southeast increased, so did the demand for recreational opportunities. To meet this demand, the Forest Service constructed more developed sites, dispersed sites, and expanded the trail networks on National Forests.

As people had more time to recreate, their expectations of the forests changed and were fulfilled through various experiences. These experiences can be occupational, recreational, or just casually related to the daily living environment. The Forest Service developed a strategy known as the Recreation Opportunity Spectrum to help identify and meet the demand for various types of experiences. Forest experiences occur in different kinds of settings which combine physical, biological, social, and managerial conditions.

These experiences are as follows:

1. Primitive experiences occur in areas with extremely high probability of isolation from human activity, limited and difficult access by foot, a closeness to nature, and a degree of challenge and risk in a large area of unmodified natural environment. These areas would be classified as wilderness on National Forests. RCW habitat management would largely occur near the perimeter of these areas with naturally occurring fires allowed to burn within cluster and foraging sites. Southern pine beetle control could occur in these areas.

2. Semi-primitive, nonmotorized experiences occur in areas with probability of isolation, access by foot, and a moderate to high degree of challenge and risk in a large area of natural-appearing environment. RCW habitat management would occur within these areas.

3. Semi-primitive, motorized experiences occur in areas with moderate degrees of isolation, but some opportunity for vehicle use, risk, challenge and self-reliance in a predominately natural-appearing area of moderate size with limited access by road. RCW habitat management would occur within these type areas.

4. Roaded natural experiences occur in areas which have about equal probability of isolation and social contact. Challenge and risk are not often present. The environment appears mostly natural as viewed from sensitive roads and trails. RCW habitat management would occur frequently in these areas.

5. Roaded modified experiences occur in areas which have about equal probability of isolation and social contact. Challenge and risk are not important. The environment has been substantially modified and is easily accessed by roads. RCW habitat management would occur most frequently in these areas.

6. Rural experiences occur in areas which have high probability for social interaction. Convenience is more important than challenge. Modifications are fairly frequent, controls are obvious and numerous, and access is designed for ease and comfort. RCW habitat management occurs in these areas.

7. Urban experiences occur in areas that have little opportunity for isolation and social contact is high. Opportunities for competitive and spectator sports and for passive uses of highly human influenced parks and open spaces are common. RCW management would not occur in these areas.

PRESENT CONDITIONS OF RECREATION RESOURCES

The demand for recreational opportunities continues to grow. During peak use periods, demand for recreational facilities often exceeds availability. A need for additional recreational sites will likely occur in the future. Part of the increased demand is caused by human population growth in the southeast. Another part is caused by changing use trends with more recreation occurring closer to home.

In 1992 the Forest Service identified forests that were classified as urban or urban-like National Forests based on distance from major population centers and characteristics of users and uses. All RCW forests except the Kisatchie National Forest were categorized as urban or urban-like forests. This serves as an indication of the demand being placed on these forests for recreational opportunities.

SCOPE OF THE ANALYSIS

This analysis focuses on the expected direct, indirect, and cumulative effects the proposed action and alternatives should have on recreational opportunities, if implemented.

DISCLOSURE OF EFFECTS

The potential for RCW management practices to adversely affect existing recreation areas or activities is minimal, even though active RCW clusters do occur within developed recreation sites and along existing trails. Management of recreation areas may create conditions attractive to RCW. Many activities associated with RCW management regularly occur within recreation areas and along trails, including prescribed burning. In addition, Forest Plans include guidelines to control/mitigate potential negative activities in and adjacent to recreation sites. In situations where active clusters occur within or very near developed recreation sites or trails, measures to lure these birds away from the recreation facility could be initiated if there are documented adverse impacts to the RCW.

Two consecutive nesting failures for a given RCW group should be considered an adverse impact and could trigger activities to lure RCW from the recreation facility. Development of recruitment stands complete with midstory control and artificial cavities are the best way to lure the birds outside the recreation area. Forests have the option of managing their RCW groups in or adjacent to recreation facilities to aid in their interpretive services and watchable wildlife programs.

The following is a brief discussion of effects of activities which could potentially affect recreation.

CLUSTER, REPLACEMENT, AND RECRUITMENT STAND PROTECTION

These activities could occur under all alternatives.

CUTTING OF TREES

Direct Effects

The only direct effect would be closing all or a portion of the recreation area during the time trees are actually being cut.

Indirect and Cumulative Effects

Cutting of trees resulting in shade reduction, loss of character trees, etc., could reduce or change the quality of the recreation experience for some people.

RESTRICTIONS ON MOTORIZED/HEAVY EQUIPMENT AND CONCENTRATED HUMAN USE

The intent of these restrictions are to protect the RCW. Therefore, the effects discussed are those resulting from implementation of the restrictions on recreation.

Direct Effects

All alternatives prohibit or recommend against concentrated use areas in clusters, replacement, and recruitment stands. These restrictions could prohibit the development of a new recreation facility or ORV trail within a RCW cluster. Alternatives A and B would restrict construction of facilities and trails on 124,520 acres. Alternatives C, D, and E would restrict construction activities on 156,720 acres. Even with the most restrictive alternatives, 98 percent of National Forest System lands in the 11 affected RCW forests would be available for construction of facilities and trails without RCW restrictions.

Indirect and Cumulative Effects

Under all alternatives, areas with dense RCW populations may limit locations for new recreational facilities. Alternatives A, C, D, and E also allow relocation or modification of existing facilities if they adversely affect RCW. The most likely occurrence would be the relocation of an ORV/motorcycle trail. This could lead to some confusion on the part of trail users and would also make existing trail brochures inaccurate.

RESTRICTIONS ON NESTING SEASON DISTURBANCE

Alternatives A, B, C, and D

Direct Effects

Alternatives A, B if less than 50 groups, C, and D prohibit disturbing activities during the nesting season. Direct effects on recreation could include closing certain trails or parts of recreation areas.

Indirect and Cumulative Effects

Closing portions of recreation areas or trails could result in disappointed recreationists, increase user conflicts in areas that are open, delay routine maintenance in affected areas, and would decrease capacity of affected facilities and result in lost income from user fees. Some use may be relocated to other nearby recreation facility. Heavy maintenance and reconstruction should be scheduled outside of nesting season.

Alternative E

Routine activities will not be restricted during the nesting season in existing clusters or if RCW move into a recreation site or along a trail. Routine activities would include things like mowing, road grading, trash pick-up, and toilet pumping in recreation areas and an occasional motorcycle or ORV on a trail.

Heavy maintenance or reconstruction within a recreation area, affected by RCW, should be scheduled outside of the nesting season. Emergency maintenance might be necessary following a severe spring or summer storm and would be considered on a case by case basis with appropriate NEPA, NFMA, and ESA compliance.

Concentrated motorcycle or ORV events (enduros) will not be allowed during the nesting season if the trail traverses any active cluster. The event could occur if the trail was relocated outside clusters or the event could be postponed until after the nesting season.

The only effect of nesting season restrictions on recreation should be the possibility of delaying certain actions until after the nesting season.

Alternative B

In populations of more than 50 groups, Alternative B would not prohibit any activity, but would try to minimize disturbance. There should be no direct, indirect, or cumulative effects on recreation.

SOUTHERN PINE BEETLE CONTROL

Active control of southern pine beetle is as likely to occur to protect a developed recreation site as it is to protect an RCW cluster.

Direct Effects

Recreation sites would be closed during the time infested trees were being cut and removed. This could take several days, depending on the size of the infested area.

Indirect and Cumulative Effects

Use of both developed and dispersed sites could be reduced, especially if all the overstory was removed. As the vegetation regrows use would again increase.

Cluster, Replacement and Recruitment Stand Management

MIDSTORY CONTROL

Of activities conducted to manage RCW clusters, only midstory removal/control could potentially affect recreation areas/activities. Midstory control would occur in all alternatives.

Direct Effects

There would be a reduction in midstory vegetation within clusters.

Indirect and Cumulative Effects

Desirable vegetative screening between camp sites could be eliminated. There could also be a reduction of tree species which are desirable in recreation ares such as dogwoods. Such effects could be mitigated by leaving understory vegetation (<10') for screening and selectively leaving desirable midstory species which are not directly affecting the cavity tree(s). Such selective midstory control may require the use of a method other than prescribed burning such as manual or herbicide.

Habitat Management

PRESCRIBED BURNING

Prescribed burning is regularly used as a tool to maintain developed recreation sites, especially in the Coastal Plain physiographic province. Burning is also the preferred method to control midstory vegetation. It could be used in all alternatives.

Direct Effects

Burning may require closure of the recreation site during the burning period.

Indirect and Cumulative Effects

Burning may cause charring of tree trunks and will affect the aesthetics of the recreation area until regrowth of ground level vegetation occurs. Mitigation to reduce the impact of midstory control on the recreation area {as described above under management of clusters} may require a method of control other than prescribed burning.

THINNING

Thinning to enhance foraging habitat could occur within developed recreation sites if the thinning also benefitted recreation resources. If it were warranted, effects would be similar to those described previously under cutting of trees to protect clusters. No other timber harvesting activities associated with RCW management would occur in recreation sites.

Regional and Local Economics

OVERVIEW

The red-cockaded woodpecker occurs on National Forest in 11 states. In 1990, these states were home to 68.3 million people. Seventy-two counties dispersed over the 11-state area have RCW on National Forest land. The population of these counties is 3.3 million, 4.8 percent of the 11 state's total population (Bureau of Census, 1990).

The South is now the leading region of the United States with respect to total wood fiber production. There are a total of 182 million acres of timberland in the South. The National Forests contribute 10.8 million acres (6 percent) to this total (USDA Forest Service 1988).

Over the past 30 years, the South has experienced substantial population growth and a considerable diversification in its economy, with a resulting reduction in its degree of dependence on timber and wood products. However, this diversification has taken place primarily in the metropolitan areas. Rural counties throughout the range of the RCW remain dependent to a greater degree on timber and wood products for their economic base.

PAST ACTIONS THAT HAVE AFFECTED THE PRESENT CONDITION

Numerous laws and policies direct timber management activities on National Forests, most of which direct the Forest Service to provide balanced resource management, protection and/or enhancement of a variety of forest values, and maintenance of a healthy forest resource that will produce sustainable timber volumes. Forest Service policy stipulates that trees will be harvested at a sustained level over time and will include other resource values and coordination requirements.

All National Forests in the Southern Region completed Forest Land and Resource Management Plans (Forest Plans) in the mid 1980s. These Forest Plans included an analysis of the complex mix of resources available from the Forests. The plans provide direction for a mix of management activities on each Forest in order to meet local and national needs.

Part of this plan direction was the determination of lands suitable for timber production. These are lands that are capable of producing industrial wood, can be adequately restocked, can be managed indefinitely without significant risk to related resource values such as soil productivity and water quality, and are not allocated to some other management objective that would preclude timber production.

The 11 National Forests included in this analysis have a total of 9,447,165 forested acres. Of these, 6,926,100 are suitable for timber production. At present, the average annual allowable sale quantity (ASQ), as specified in the 11 Forest Plans is 1221.9 million board feet per year (Table 3-7).

Table 3-7
Lands Suitable for Timber Production (Thousands of Acres) and ASQ for the Eleven National Forests with RCW.

Total Forested Acres	Total Acres Suitable For Timber Production	Annual Average ASQ (MMBF/yr.)
9447.2	6926.1	1221.9

Past annual levels of timber sold have typically exhibited a degree of fluctuation. In the mid 1980s, the 11 RCW forests were selling approximately 1200 million board feet annually.

In 1988, the annual volumes sold began to decline for a variety of reasons:

- Natural catastrophes, such as southern pine beetle epidemics, hurricanes, and tornadoes, on several of the major timber producing forests greatly altered the availability of areas for harvest.
- Implementation of forest plan standards, guidelines, and objectives for other resource values, including endangered species, resulted in per acre yield reductions and allocation of less harvest treatment because of spacing requirements.
- Settlement agreements for appeals of Forest Plans has resulted in changes in how the plans are implemented. These changes have further limited harvest or the yields that could be produced.
- Although most Forest Plans allowed an array of silvicultural options, the ASQs (1221.9 MMBF level) were projected on clearcutting as the primary harvest method. Since initial Forest Plan implementation began in the mid 1980s, there has been a 60-70 percent reduction in acres being harvested with the clearcut method. A change in harvest method of this magnitude has had a significant impact on the volumes that can be harvested.

These changes reflect the continued trend toward a more diverse mix of resource management objectives for the National Forests.

Past Outputs

The past timber harvest levels from the 11 National Forests included in this analysis are shown in Table 3-8. The table displays the total actual pine volume harvested from the 11 Forests over the last five years (FY 87-94). It also displays the average volume harvested for that time period.

Table 3-8
Pine Timber Harvest Levels Since 1987 (Billions of Board Feet per Fiscal Year)

1987	1988	1989	1990	1991	1992	1993	1994	Average
1.12(.66)*	1.12(0.64)	0.84(0.49)	1.14(.68)	.76(.41)	1.06(0.59)	.74(.38)	.66(.34)	.93(.52)

* Number in parenthesis represents sawtimber volume in billion board feet

The total historic employment associated with these timber harvest from the 11 National Forests are estimated in Table 3-9. The figures represent the total employment, including direct, indirect, and induced effects. Total employment generated by National Forest timber harvest has averaged 11,224 jobs per year over the previous seven fiscal years (FY '88-94).

Table 3-9
Employment Levels Generated by National Forest Timber Harvest (Jobs Per Fiscal Year) Since 1988.

1988	1989	1990	1991	1992	1993	1994	Average
11223	9412	12245	8523	9545	14626	12994	11224

Source - Annual TSPIRS Reports, FY '88-91, Southern Region, USDA-FS

The total historic income generated by the harvest of National Forest timber for each of the 11 Forests is displayed in Table 3-10. The income figures shown represents total personal income. Total income generated by National Forest timber harvest has averaged $296.9 million per year over the previous seven fiscal years (FY '88-91).

Table 3-10
Income Levels Generated by National Forest Timber Harvest (Millions of Dollars Per Fiscal Year) Since 1988.

1988	1989	1990	1991	1992	1993	1994	Average
284.3	227.7	278.3	190.5	228.5	461.7	407.3	296.9

Source - Annual TSPIRS Reports, FY 88-91, Southern Region, USDA-FS

Payments to States - National Forest timber harvest throughout the range of the RCW is a source of revenue in terms of returns to the Federal Treasury and payments to states.

Payments to states is a form of revenue sharing in which 25 percent of the revenues collected on the National Forests is returned to the states for use in funding roads and schools. These funds from each forest are paid to the states for distribution to the counties within that forest, based on their percentage of the total acreage. The past, total payments distributed to states associated with the 11 National Forests with RCW are shown in Table 3-11. These display the actual payments to states, generated only from timber harvest, distributed within the Region over the last eight years. It also displays the average between 1987 - 1994.

Table 3-11
Payments to States Generated by National Forest Timber Harvest (Thousands of Dollars per Fiscal Year) Since 1987.

1987	1988	1989	1990	1991	1992	1993	1994	Average
17496.8	11806.3	10735.6	15040.3	10936.9	12523.0	11272.0	6247.0	12007.2

Source - Southern Region, USDA-FS Annual Collection Statements, FY 87-94.

Scope of the Analysis

The economic analysis focuses on the regional economic effects that the various alternatives would have on timber related employment and income generated from the 11 National Forests which have RCW. It describes how changes in forest management associated with recovery of the RCW may affect timber-related employment, income and payments to the states through the 25-percent fund. Appendix F presents similar information for each of the 11 National Forests with RCW.

The following tables are based on regional averages and as such should be viewed only as a means of making relative comparisons between alternatives. They are not an accurate depiction of actual site specific local conditions. The timber volume projections are not commitments, but simply estimates for comparison purposes. These volume projections only take into account effects of RCW management. They do not consider any other factors that may affect available volume such as other forest plan standards and guidelines or budgets. Because of other constraints, actual volumes available may be less than those projected in the tables. Again, it is important to remember these tables are only presented to allow for relative comparisons between alternatives. The economic analysis of local conditions will occur when individual forest plans are amended or revised.

DISCLOSURE OF EFFECTS

The following elements included in the alternative will affect the timber volumes available for harvest. Available timber volume will in turn affect local or regional economics, through reduced jobs and income.

These effects will not be evenly distributed across the 11 forests, but will vary depending on the individual considerations and intensity of past management activity on each unit.

- Extension of rotations,

- Requirements to provide adequate foraging habitat,

- Extended use of irregular shelterwood and uneven-aged regeneration methods,

- Strict adherence to limits set on acreage allowed in the 0-10 and 0-30 age classes,

- Protection of the oldest 1/3 of pine and pine/hardwood acres until they reach rotation age.

These items individually or collectively result in reduced per acre values from timber and affect timing for future harvest treatments.

The establishment of tentative HMAs should have no effect on timber volumes available from the areas between the 3/4-mile radius circles covered by the Interim S&Gs. Even though specific harvest methods are specified, no other components of individual Forest Plans are modified.

Counties as Units of Analysis - This EIS is a Regional programmatic document. The decision associated with the EIS will cause three immediate actions: (1) The RCW chapter of the Handbook will be revised, (2) Forest Plans will be amended to establish tentative RCW HMAs, and (3) specific even-aged regeneration methods will be restricted within the tentative HMAs until each affected National Forest has incorporated the complete new Handbook direction into their Forest Plans. Incorporating the new Handbook into Forest Plans will require an amendment or revision with appropriate NEPA, NFMA and ESA analysis and compliance.

This forest-level analysis will make land allocations through identifying the final HMAs. It is recognized that implementation of the proposed alternatives in this Regional environmental impact statement could result in changes in commodity production and a subsequent effect on regional and local economics. In order to make an informed decision when selecting a preferred alternative, the deciding officer must consider the economic effect of the decision

This economic analysis considers the 72 counties within the 11 National Forests with RCW to determine their dependence on National Forest timber as a major part of their economic base. Variables considered in this analysis include the percent of each county in Forest Service ownership, the percent of the county that is forested, the percent of county employment associated with the lumber and forest products industry, county population, the number of loggers, mills, etc., that are dependent on the National Forests for greater than 15 percent of their raw materials, and the percentage of each counties' education budget represented by Forest Service contributions through the 25-percent fund.

Based on this analysis, four counties and one parish were identified as the most dependent on National Forest timber. They are: Jasper and Putnam Counties, Georgia; Liberty County, Florida; Scott County, Arkansas; and Winn Parish, Louisiana.

The analysis then determines timber volumes which could be harvested from National Forest System land within these counties/parish for each of the alternatives. The IMPLAN input-output economic modeling system was then used to determine economic impacts of the various alternatives on the selected counties. The results of this sample was used to estimate economic impacts across the 11 National Forests with RCW.

Timber Volumes - Projected timber volumes from the 11 National Forests with RCW are based on two assumptions. 1) The area outside tentative RCW HMAs will continue to produce timber at a level similar to what they have in the past and 2) past timber harvest was evenly distributed over all areas of the forest identified as suitable for timber management.

Two of the factors affecting available volumes are the extension of rotations and the acreage allowed in the 0-10 and 0-30 age classes. These factors in conjunction with existing acreage in the 0-10 and 0-30 age classes tend to limit available volumes the first 10-20 years after implementation. As the acres currently in these critical age classes grow older, limitations are less. Therefore, volumes are projected 30 years into the future by 10-year period to illustrate the cumulative effects and impact through time. Table 3-12 and Figure 3-1 show the estimated volumes of sawtimber and pulpwood available on a Regional basis by alternative and 10-year period.

Table 3-12
Estimated Harvest Levels by Alternative and Time Period.
(Millions of Board Feet per Fiscal Year)

Time Period	Baseline* Volume	Alternatives A	B	C	D	E
Year 1-10						
Sawtimber	503	376(-25)**	401(-20)	334(-34)	313(-38)	396(-21)
Pulpwood	402	336(-16)	345(-14)	336(-16)	291(-28)	344(-14)
	905	712(-21)	746(-18)	670(-26)	604(-33)	740(-18)
Year 11-20						
Sawtimber	503	380(-24)	423(-16)	360(-28)	326(-35)	415(-17)
Pulpwood	402	341(-15)	352(-12)	350(-13)	307(-24)	352(-12)
	905	721(-20)	775(-14)	710(-22)	633(-30)	767(-15)
Year 21-30						
Sawtimber	503	417(-17)	489(-3)	384(-24)	330(-34)	409(-19)
Pulpwood	402	330(-18)	380(-5)	362(-10)	277(-31)	355(-12)
	905	747(-17)	869(-4)	746(-18)	607(-33)	764(-16)

* Baseline volumes are based on the average volume of pine sawtimber and pulpwood harvested from the 11 affected National Forests 1987-89, prior to implementation of Interim S&Gs. The 905 MMBF baseline is a reduction from the baseline used in the DEIS for the following reasons:

1. The current baseline takes into account the devastating effects of Hurricane Hugo on the Francis Marion National Forest. The baseline in the DEIS included 100 MMBF coming from the Francis Marion. Not making an adjustment to the baseline volume to take into account unavailability due to storm damage would attribute the volume reduction under the alternatives to RCW management, not the effect of the hurricane. Eighteen MMBF were included in the current baseline coming from the Francis Marion. This is the volume the Forest estimated could be harvested annually for the first decade under Alternative B, the guidelines that would have been in effect during the baseline period.

2. Current baseline volumes were also adjusted to account from hardwood volumes that were erroneously included in the DEIS baseline. Hardwood volumes will not be affected by RCW management and should not be included in baseline volumes.

The adjustments made for hurricane damage and inclusion of hardwood volumes were made across all alternatives for all time periods as well.

** The number in parenthesis is the percentage change from the baseline volumes.

This analysis discloses the effects of the alternatives at a Regional level across the range of the RCW. It is recognized that some individual Forest Service units will experience greater reductions in available volumes. This is especially true of districts/forest where all suitable RCW habitat is included in the tentative HMA. Some of these units may be able to cut little or no sawtimber the first 10-20 years. This is due to existing RCW foraging requirements and existing acreage in the 0-30 age classes. The degree of impact will decrease with time, but on these Forest Service units reduction in available volumes in the first 10-year period may be two to three times as great as the Regional effect.

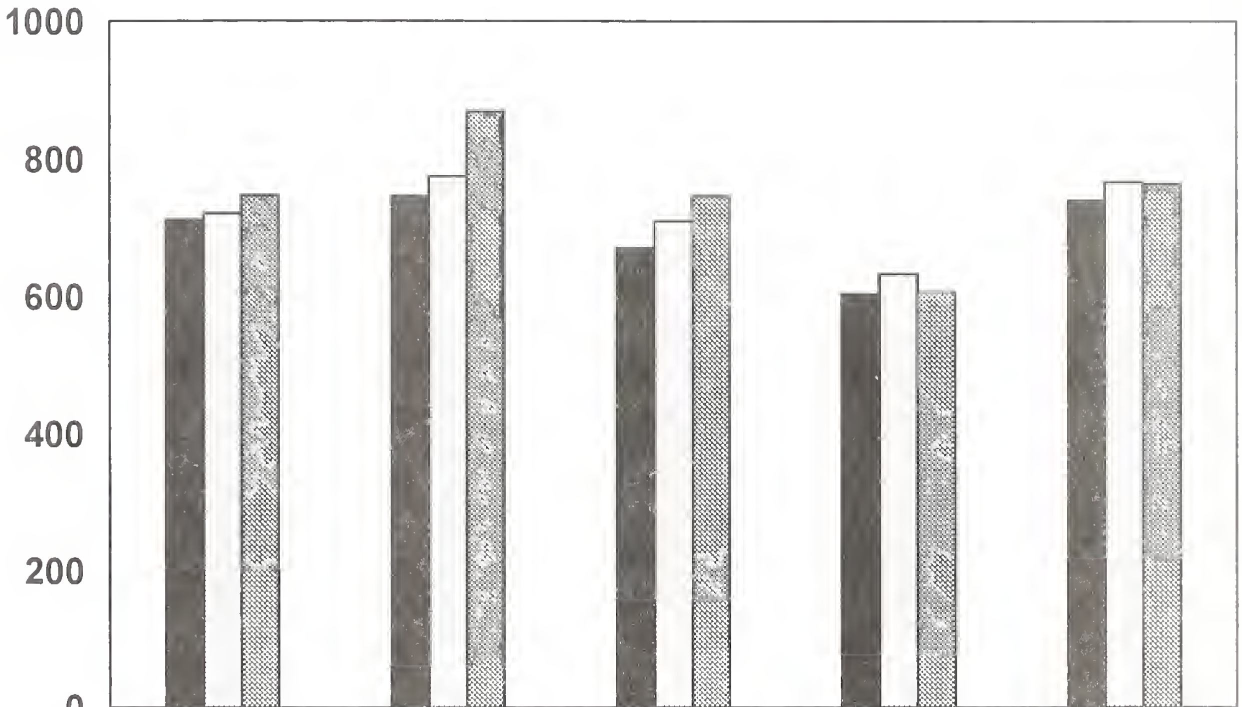
Alternative D exhibits the greatest reduction in available volumes but produces relatively stable outputs over the 30-year period analyzed. This alternative does not have a planned sustained yield of timber. It does, however, allow thinning of young stands and mature stands in pine species susceptible to southern pine beetle. It also allows regeneration to restore desirable pine species such as longleaf pine. The majority of the volume available over the 30-year period is being generated by these activities. At a point in the future, when all pine restoration has been completed and all young stands appropriately thinned, available volumes will likely drop well below those shown in Table 3-12.

Alternative B, which is modeled after the 1985 Handbook Chapter with some modifications, also exhibits a reduction in available volumes. These reductions are due to the change in how foraging availability is calculated per the Fish and Wildlife Service's Blue Book (Henry 1989) and the current acres in the 0-30 age classes. Over time, volumes available under this alternative do approach historic harvest levels. Changes made to Alternative E based on comments on the DEIS will allow more timber to be harvested. For the first 20 years of implementation, Alternative E has nearly the same potential for volume production as Alternative B.

Alternatives A, C, and E generate similar volumes over the 30-year period at a level between alternatives B and D, with Alternative E producing the most volume of these tree alternatives.

Employment and Income - Only a small portion of each of the 11 states' total 1989 employment is in the lumber and wood products industry. Mississippi and Arkansas have the greatest portion of their employment associated with forest and wood products with 4.5 percent and 4.3 percent, respectively. Florida and Texas are the least dependent with 0.9 percent of their work force involved with lumber and wood products (Bureau of Census, 1989).

Figure 3-3 Estimated Harvest Levels by Alternative and time Period.
(Millions of Board Feet per Fiscal Year)



	A	B	C	D	E
Decade 1	712	746	670	604	740
Decade 2	721	775	710	633	767
Decade 3	747	869	746	607	764

Decade 1 Decade 2 Decade 3

However, these statewide percentages mask the dependence on this sector of the economy in many rural counties associated with timber supplies from National Forest. Throughout the range of the RCW, many counties depend on this industry for 10-12 percent of their total jobs. Some are even more dependent.

For example, Jasper County, Georgia, depends on the forest products industry for 56 percent of its jobs. Perry County, Mississippi, depended on this industry for 48 percent of its jobs. Winn Parish, Louisiana, derives 41 percent of its employment from timber-related industries. Liberty County, Florida, is dependent on forest products for 25 percent of its employment (Micro IMPLAN Data Base 1990, developed from published and unpublished Census data by the Univ. of Minnesota for USDA Forest Service).

The employment and income estimates displayed in the following tables were developed using the IMPLAN input-output economic modeling system. They include the total effect throughout the economy associated with timber harvesting and processing. The totals include three separate components: direct effects, indirect effects, and induced effects.

These components are defined as follows:

> **Direct Effects** - Those that impact sectors either exporting processed wood products from the economic area or selling those products to final consumers. An example of direct employment would be people working in a sawmill.
>
> **Indirect Effects** - Those that impact other production, trade, and service sectors that provide the production inputs needed to manufacture the processed wood products. An example of indirect employment would be people who manufacture the saw blades used in the sawmills.
>
> **Induced Effects** - Those that impact consumer spending within the economic area associated with jobs that support the direct and indirect production. An example of induced employment would be grocery store employees who sell products to the people working in sawmills or making saw blades.

The estimated employment associated with the harvest of timber from the 11 National Forests with RCW is shown in Table 3-13 and Figure 3-2. As with the available volume projections, employment is displayed by alternative and time period.

Table 3-13
Estimated Employment Levels Generated by National Forest Timber Harvest.
(Jobs per Fiscal Year)
Employment levels increase over time in all alternatives except D.

Time Period	Baseline Empl.*	Alternatives				
		A	B	C	D	E
Year 1 - 10	8,600	6,600	7,000	6,300	5,700	6,900
Year 11 - 20	8,600	6,800	7,300	6,500	6,000	7,100
Year 21 - 30	8,600	7,100	8,100	7,100	5,700	7,200

* Baseline employment is based on the average employment generated by harvest of National Forest timber in 1988 - 89, prior to implementation of Interim Standards and Guidelines.

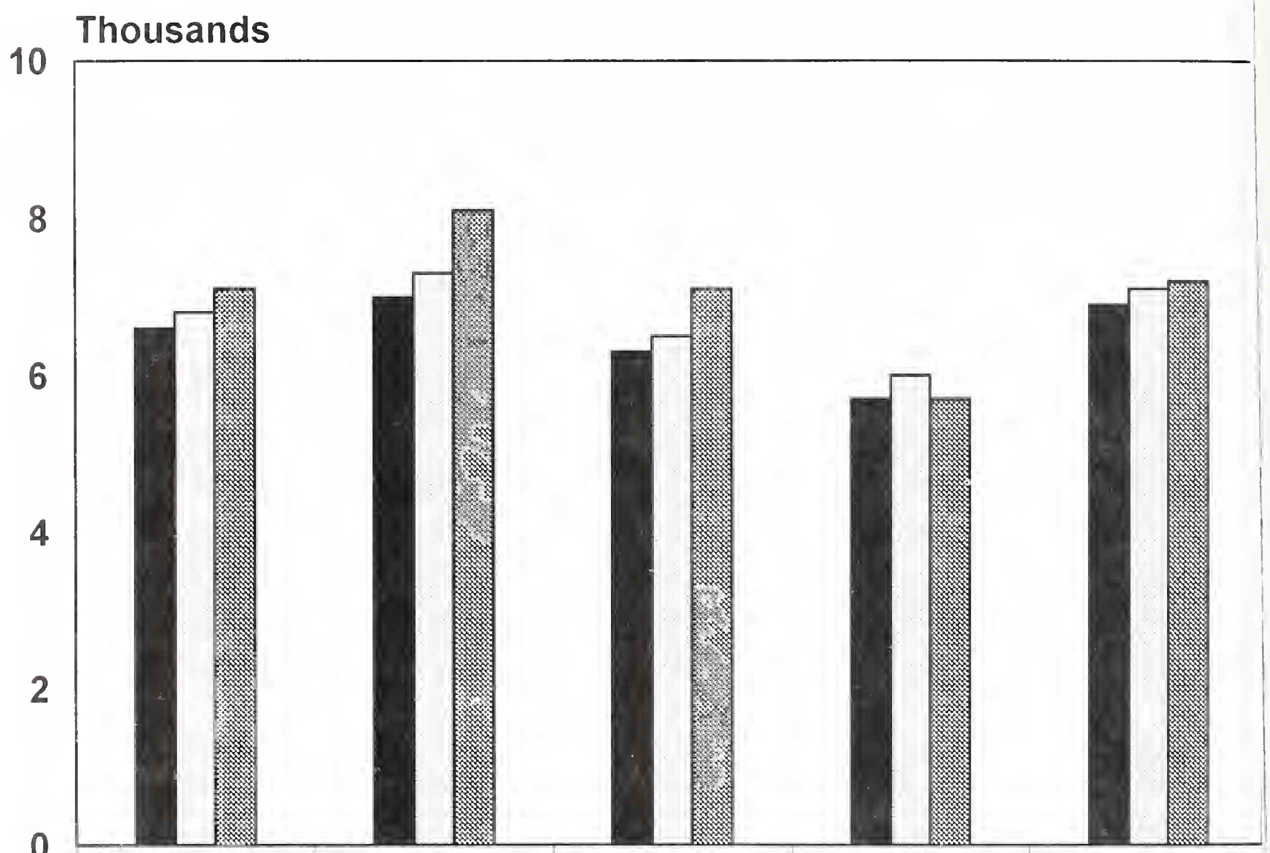
The estimated income generated by the harvest of National Forest timber on the 11 National Forests with RCW is displayed in Table 3-14 and Figure 3-3. It is shown by alternative and time period.

Table 3-14
Estimated Income Levels Generated by National Forest Timber Harvest.
(Millions of Dollars per Fiscal Year)

Time Period	Baseline Income*	Alternatives				
		A	B	C	D	E
Year 1 - 10	217	171	179	161	145	178
Year 11 - 20	217	173	186	170	152	185
Year 21 - 30	217	179	209	179	146	183

* Baseline income is based on the average income generated by harvest of National Forest timber in 1988-89, prior to implementation of Interim Standards and Guidelines.

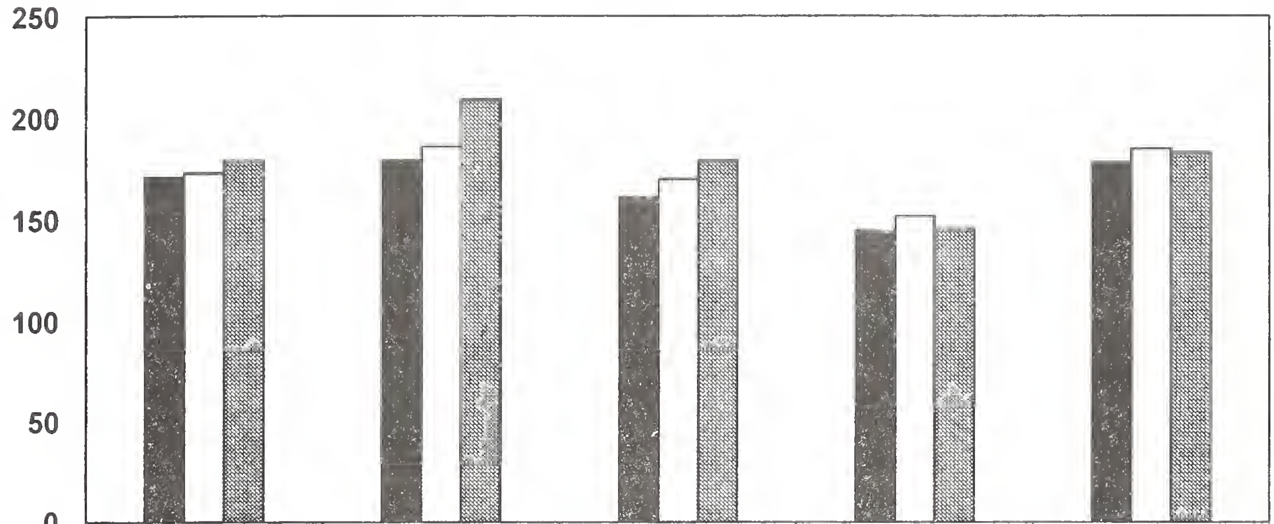
Figure 3-4
Estimated Employment Levels Generated by National Forest Timber Harvest.
(Job per Fiscal Year)



	A	B	C	D	E
Decade 1	6.6	7	6.3	5.7	6.9
Decade 2	6.8	7.3	6.5	6	7.1
Decade 3	7.1	8.1	7.1	5.7	7.2

Decade 1 Decade 2 Decade 3

Figure 3-5
Estimated Income Levels Generated by National Forest Timber Harvest.
(Millions of Dollars per Fiscal Year)



	A	B	C	D	E
Decade 1	171	179	161	145	178
Decade 2	173	186	170	152	185
Decade 3	179	209	179	146	183

Changes in employment and income are based on the estimated volumes from Table 3-12. Therefore, explanations of reductions in volumes apply to reductions in employment and income, as well.

Reductions in available volumes resulting from the implementation of the alternatives have already been described. It is logical to assume these reductions would also result in a reduction in revenues to the states/counties through the 25% fund. However, this may or may not be a valid assumption of effects.

Projected payments to the states are based on the average price received per MBF of sawtimber and pulpwood during the period October 1, 1993 - June 30, 1994. During this period the average revenue received per MBF of sawtimber and pulpwood was $148.88. Average revenue generated per MBF during the 1987-89 base line period was $49.26. Even though available volumes decreased from 18 percent to 33 percent due to implementing the various alternatives, the increase in timber values more than offset the reduced volumes. Thus, the effects of any alternative will also be dependent on the variation in timber prices and mix of forest products produced.

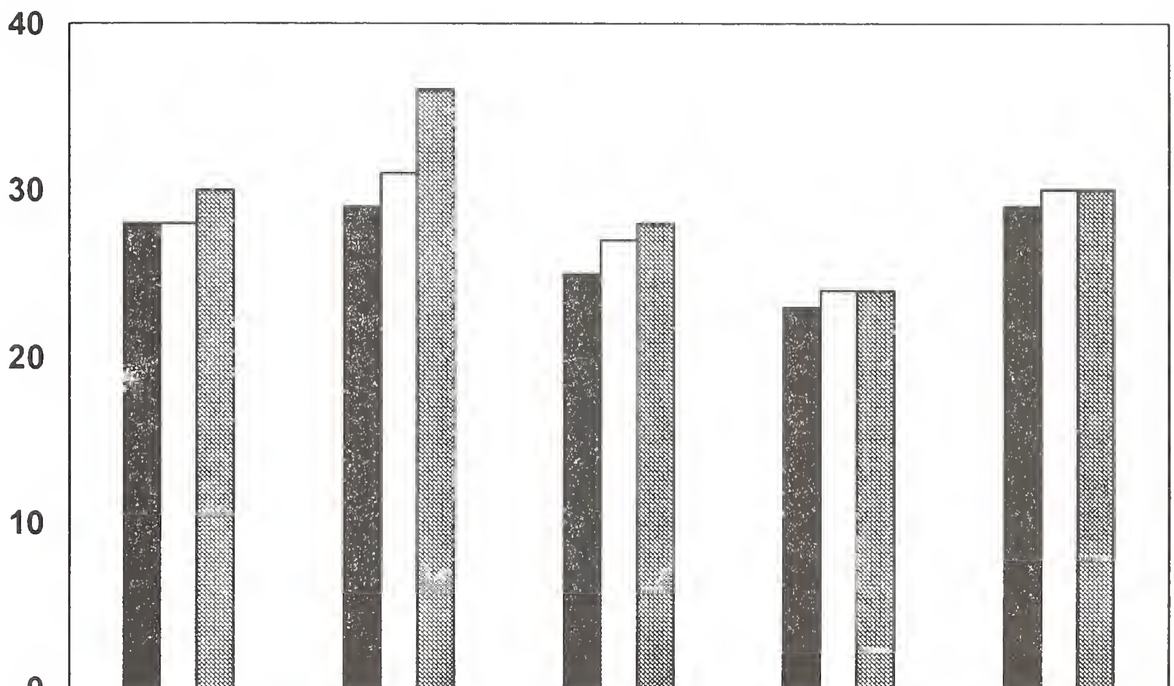
The estimated dollars available for distribution to the states for use by the counties for roads and schools are displayed in Table 3-15 and Figure 3-4. These estimates are based on the projected volumes of pine sawtimber and pulpwood from Table 3-12. These values are only approximations to show the differences between the alternatives. Actual dollar amounts available could vary significantly. Because of the tremendous difference in value between sawtimber and pulpwood, the $148.88 average per MBF was not used to calculate the values in Table 3-15. The regional pine sawtimber average value of $264.81 per MBF was used for sawtimber volume, $32.94 per MBF was used for pulpwood volume. Baseline values were calculated using the 1994 stumpage rates stated above, so comparisons could be made.

Table 3-15
Estimated Payments to States Generated by National Forest Timber Harvest.
(Millions of Dollars per Fiscal Year)

Time Period	Baseline* Payments	Alternatives				
		A	B	C	D	E
Year 1 - 10	37	28	29	25	23	29
Year 11 - 20	37	28	31	27	24	30
Year 21 - 30	37	30	36	28	24	30

* Baseline payments to states are based on the average payments generated by harvest of National Forest timber in 1987-89, prior to implementation of Interim Standards and Guidelines. Baseline rates are presented in 1994 values.

Figure 3-6
Estimated Payments to States Generated by National Forest Timber Harvest.
(Millions of Dollars per Fiscal Year)



	A	B	C	D	E
Decade 1	28	29	25	23	29
Decade 2	28	31	27	24	30
Decade 3	30	36	28	24	30

Decade 1 Decade 2 Decade 3

As with timber volumes, assessing the impact of the alternatives on revenues available to the counties at a Regional level tends to mask the effect on individual ranger districts or National Forest. It is recognized that some individual Forest Service units will experience reductions in the returns to states. This is especially true of districts/forest where all suitable RCW habitat is included in the HMA.

Some of these units may be able to cut little or no sawtimber the first 10-20 years. This is due to existing RCW foraging requirements and existing acreage in the 0-30 age classes. Sawtimber represents the majority of the revenue generated by the harvest of National Forest timber, therefore these units may experience a decrease in funds available for the states.

Most National Forests with RCW have traditionally received more money for the timber they sell than it cost to mark the timber and prepare the sale. Only one National Forest, the Daniel Boone in Kentucky, has not made enough money from its timber sales to meet expenses (below cost). As a result of implementing any of the various alternatives, a forest could be placed in a below-cost situation. The more extreme economic effects will occur on those forests where present conditions greatly restrict the future options under any alternative.

The National Forests in Florida are representative of this situation. This is due to the current method of calculating foraging habitat (providing 6350 pine stems 10 inches or greater in diameter, versus 125 acres of pine forest meeting specific criteria) and past management practices which recommended thinning all mature pine stands to a basal area of 60 square feet. These limitations essentially prohibit harvest of sawtimber size trees.

The degree of impact will decrease with time as the stands currently in the 0-30 age classes grow older. This will again allow the harvest of sawtimber from the RCW HMAs, which will in turn increase revenues to a point greater than the cost of preparing sales (above cost).

CHAPTER 4

PREPARERS OF THE EIS

Full-time Team Members

JOSEPH M. DABNEY - was the team leader from February 1991 to August 1994. He was the team wildlife biologist from July 30, 1989 until his selection as team leader. Joe has a bachelor of science degree in Forestry and a master of science degree in Wildlife and Fisheries Science from the University of Tennessee at Knoxville. He is completing his 19th year with the Forest Service and has had assignments in Arkansas, Virginia, Colorado, Tennessee, and Georgia. His principal area of expertise is in wildlife biology; in addition, his positions have given him responsible supervisory and practical experience in threatened and endangered species, fisheries, fire management, recreation, silviculture, range management, and wilderness. He is a member of The Wildlife Society, Ruffed Grouse Society and the National Wild Turkey Federation. Joe is currently serving as District Ranger, Sylamore Ranger District, Ozark National Forest.

Team leader responsibilities include overall management and supervision, as well as coordination with others and accountability to management.

DAVID P. SMITH - was the original team leader (June 1989 - January 1991), for the RCW EIS Team. He holds a B.S. in forestry from Southern Illinois University, Carbondale, IL. David has 18 years' service in positions involving timber management, silviculture, recreation, and other forest resource management. Assignments were on National Forests in South Carolina, Mississippi, Illinois, and the Regional Office in Atlanta. He served as team member and team leader (June 1985 - June 1987) on the team that prepared the EIS for Suppression of the Southern Pine Beetle-Southern Region. He also served as team leader (December 1987 - June 1989) for the preparation of the Appalachian Integrated Pest Management (AIPM) Gypsy Moth EIS. Prior to Forest Service positions, served for three years as a park planner with the Maryland Department of Natural Resources, Annapolis, MD, and was a certified silviculturist in the Southern Region. David is currently serving as District Ranger, Chestatee Ranger District, Chattahoochee National Forest.

DENNIS L. KRUSAC - has been the team leader since August 1994. From August 1991 to August 1994 he served as team biologist. He received a bachelor of science degree in wildlife management from Michigan State University at East Lansing, MI, and worked on his master of science degree in wildlife biology at West Virginia University, Morgantown. Dennis is in his 15th year with the Forest Service and has had assignments in Ohio, South Carolina, Tennessee, and Georgia. His principal area of expertise is threatened and endangered species management. He has worked with red-cockaded woodpecker, peregrine falcon, bald eagle, northern flying squirrel, and several endangered plant species. Dennis is a certified wildlife biologist and an active member of numerous professional and conservation organizations including The Wildlife Society, Society for Conservation Biology, Wilson Ornithological Society (life member), National Wild Turkey Federation, and Ruffed Grouse Society.

JOHN J. PETRICK - has been the team silviculturist since December, 1989. He has a bachelor of science degree in forest management from Mississippi State University, Starkville, MS. John is in his 15th year with the Forest Service.

Before his assignment to work on the RCW EIS, John has worked on the Daniel Boone National Forest in Kentucky, the Apalachicola National Forest in Florida, and the Ouachita National Forest in Arkansas. His principal area of expertise is in forest management and silviculture. He has extensive experience with prescribed burning, forest ecology, nongame wildlife, and environmental planning. John is a registered professional forester in the state of Mississippi.

GEANIE H. COOPER - was the RCW EIS team program clerk. She has just completed 22 years of Federal service, having served the first four years with the APHIS Agency and the remainder with the Forest Service. For nine years, she was assigned to the Planning and Budget staff in the Regional Office before transferring to the RCW Team.

She was responsible for editing, typing, layout of RCW documents, mailing list, and mailing of documents. Geanie is now retired.

PART-TIME TEAM MEMBERS

JIMMY S. WALKER - is a silviculturist in the Regional Office. He has a bachelor of science degree in forestry from Mississippi State University. Jimmy is entering his 31st year with the Forest Service and has assignments in West Virginia, North Carolina, Mississippi, South Carolina, Louisiana, and Georgia. He worked for the Mississippi Forestry Commission for one year. His principal area of expertise is in silviculture. In addition, his previous positions have given him responsible experience in administrative and supervisory experience in timber management, silviculture, wildlife, prescribed fire, recreation, watershed, and human resource programs. He is a member of the Society of American Foresters and American Forestry Association.

Part-time responsibilities include input and review for all silvicultural activities and effects on vegetation.

ROBERT G. HOOPER - has been a research wildlife biologist with the Southeastern Forest Experiment Station for 25 years. He received a B.S. degree in biology from Lynchburg College and an M.S. degree in wildlife management from the Virginia Polytechnic Institute and State University. His research on the red-cockaded woodpecker since 1976 has resulted in 18 publications on foraging habitat requirements, cavity tree selection, colony formation, population trends, population assessment techniques, catastrophic events, sociobiology, behavior, and artificial cavity technology. He is currently working on eight studies related to red-cockaded woodpeckers, and is actively involved in the restoration of the Francis Marion National Forest following Hurricane Hugo. Bob has served as a consultant to the development of two recovery plans for the red-cockaded woodpecker, and assisted in the development of several Forest Service guidelines for management of the species. He was a participant in the 1990 Red-cockaded Woodpecker Summit.

RICHARD N. CONNER - has a B.A. in biological sciences from Rutgers, The State University, an M.S. in wildlife management from Virginia Polytechnic Institute and State University,and a Ph.D. in zoology from Virginia Polytechnic Institute and State University. He is currently employed as research wildlife biologist with the Wildlife Habitat and Silviculture Laboratory, Southern Forest Experiment Station, USDA Forest Service, Nacogdoches, Texas. He has studied bird behavior and ecology for the past 20 years. Dick has been with the lab since 1977. He has taught ornithology, animal ecology, quantitative ecology, and other life science courses at Stephen F. Austin State University and Virginia Polytechnic Institute and State University. Most of his research has focused on woodpeckers and other cavity nesting birds. Of his 124 published manuscripts, 65 have pertained to the ecology, behavior, and management of red-cockaded woodpeckers. Conner has presented or coauthored 85 ornithological papers at regional, national, and international meetings of scientific societies; 42 of these papers have dealt with the ecology, behavior, and management of the red-cockaded woodpecker. Richard was a participant in the 1990 Red-cockaded Woodpecker Summit.

D. CRAIG RUDOLPH - has a B.A. in zoology from the University of California, an M.A. in zoology from the University of California, and a Ph.D. in zoology from Texas Tech University. He is currently employed as a research ecologist at the Wildlife Habitat and Silviculture Laboratory, Southern Forest Experiment Station, USDA Forest Service, Nacogdoches, Texas. He has been employed by the lab since 1986. Craig has studied red-cockaded woodpecker ecology, behavior, and management for the past five years. Of his 15 published manuscripts, 12 have dealt with red-cockaded woodpeckers. He has presented or coauthored 24 papers at regional, national, and international meetings of scientific societies; 17 have dealt with the ecology, behavior, and management of the red-cockaded woodpecker. Craig was a participant in the 1990 Red-cockaded Woodpecker Summit.

RONALD E. F. ESCANO - has a B.S. in wildlife management from Humboldt State University, Arcata, CA; an M.S. in Ecology, with emphasis in avian population dynamics, University of California, Davis; and graduated as a 2nd Lieutenant from Officer Training School, USAF. Ron is active in numerous professional societies: Wildlife Society, Ecological Society of North America, Coopers Ornithological Society, and the American Ornithologist Union. His assignments with the Forest Service has been in California, North Dakota, Montana, Georgia, and North Carolina. His participation with T&E Species Special Groups include; Lost River Sucker Recovery Team, California Peregrine Falcon Working Group, Montana Bald Eagle Working Group, and Southeastern T&E Species Committee--Wildlife Society. Ron is presently serving as Resource Staff Officer for the National Forests in North Carolina. He was a participant in the 1990 Red-cockaded Woodpecker Summit.

MADELINE SANTIAGO - has served as the team editorial assistant since June 1993. She started her career with the Forest Service in July 1992 as receptionist to the Personnel Unit. On April 1993 she was promoted as assistant to the administrative specialist. She serves as program support assistant to the Civil Rights Unit since December 1993, where she is responsible for providing a variety of administrative and budgetary services to the unit. Before pursuing a career with the Forest Service, Madeline worked with a property and casualty insurance company in Atlanta for two years. She also has extensive experience in the human resources field through working as personnel administrator for almost five years in Ponce, Puerto Rico. Madeline holds a bachelor's degree in secretarial sciences from the Catholic University of Puerto Rico.

She was responsible for all word processing, including typing, design of tables, and document layout. Her abilities with Word Perfect have contributed to the overall quality of the EIS, especially the quality of presentation.

RICHARD GREENHALGH -was an economist in the Regional Office. He has a BS degree in Vocational Education and a MS degree in Agricultural Economics from the University of Nebraska, and a PhD with emphasis in natural resource economics from the University of Missouri. Richard's experience includes 15 years in USDA, Economic Research Service and 14 years as an economist with the Forest Service. His responsibilities include coordinating and conducting social and economic analysis in support of forest resource management in the Southern Region.

Richard was responsible for coordinating and conducting the social and economic analysis for the RCW EIS. He recently retired from the Forest Service.

CHAPTER 5

PUBLIC DISTRIBUTION OF THIS DOCUMENT

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Auddlits, Michael

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Young, Roy

AGENCIES/BUSINESSES/ORGANIZATIONS

1000 Friends of Florida - Hobe Sound, Florida
1000 Friends of Florida, Tallahassee, Florida
18th Airborne Corp, Endangered Species Branch - Fort Bragg, NC
Acadiana Dirt Riders - Lafayette, Louisiana
Adams & Reese - Mobile, AL
ADCNR State Lands Division - Montgomery, AL
Admin. Coop. Ext. Service - Prairie View, Texas
ADV Council Historic Preserv Eastern Office of Review - Washington, DC
AFZA-PW-DS - Ft. Bragg, NC
Agriculture Stabilization & Conservation - New Bern, North Carolina
Alabama Forestry Commission - Montgomery, AL
Alabama Forestry Assoc - Montgomery, AL
Almond Brothers Lumber Company - Coushatta, Louisiana
AM Farm Bureau Federation - Park Ridge, IL
American Forest & Paper Assoc. - Atlanta, Georgia
American Rivers Council - Washington DC
American Motorcyclist Assn - Westerville, OH
American Pulpwood Association - Hamilton, VA
American Forests & Paper Association - Washington, DC
American Fisheries Society - Bethesda, MD
Angelina County Farm Bureau - Lufkin, Texas
Apalachee Audubon Society - Tallahassee, Florida
Appalachian Science in Pub Int. - Livingston, Kentucky
Appalachian Trail Conference - Asheville, North Carolina
Appalachian Hardswood Manufacturers - Morehead, Kentucky
AR Game & Fish Commission - Little Rock, AR
Arkansas Nature Conservancy - Little Rock, AR
Arkansas Forestry Association - Little Rock, AR
ASARCO Inc. - Maryville, Tennessee
Ashland Daily Independent - Morehead, Kentucky
Assistant Attorney General - Austin, Texas
Associated Press - Pikeville, Kentucky
Associated Press - Washington, DC
Atlanta Audubon Society - Atlanta, Georgia
Attorney-Advisor, Dept of AF - Robins AFB, Georgia
ATZH-DIE (Forestry) - Fort Gordon, Georgia
ATZJ-PWN-NR - Ft. Jackson, SC
Audubon Society - Ocean Springs, MS
Audubon Society, Bukley Hills - Versailles, Kentucky
B.A. Mullican LMBR - Maryville, Kentucky
Baker County BD of Commissioners - Macclenny, Florida
Base Forester/NREA Division - Camp Lejeune, NC
Bates Associates - Atlanta, Georgia
Battle Mountain Exploration Co. - Charlotte, North Carolina

AGENCIES/BUSINESSES/ORGANIZATIONS -continued

Berkeley Co. Planning Comm - Moncks Corner, SC
Bienville Quail Association - Ridgeland, MS
Big South Fork NR & Rec. Area - Oneida, Tennessee
Big Thicket Coord. Comm. - Denton, Texas
Big Thicket National Preserve - Beaumont, Texas
Biodiversity Legal Foundation - Boulder, Colorado
Board of Supervisors, Adams County - Natchez, MS
Boise Cascade Corp. - DeRidder, Louisiana
Boone Karst Cons. Task Force - Frankfort, Kentucky
Bowater Inc. - Catawba, SC
Breedlove, Dennis, & Assts - Winter Park, FL
Breezy Hill Enduro Club - Pollock, Louisiana
Broadview Ranches - Centreville, MS
Camp Shelby Training Site - Camp Shelby, MS
Cape Romain National WL Refuge - Awendaw, SC
Capital RC&D - Denham Springs, LA
Capitol City 4-Wheel Drive Association - Carry, North Carolina
Captive Breeding Specialist - Apple Valley, MN
Carteret Wildlife Club - Morehead City, North Carolina
Carteret County Environmental Resources Commission - Beaufort, North Carolina
CENLA Trail Riders - Pollock, Louisiana
CENLA SAF - Bently, Louisiana
Central LA Quail Hunters - Ball, Louisiana
Central LA Quail Hunters - Pineville, Louisiana
Central Piedmont Sierra Club - Charlotte, North Carolina
Charleston County Planning - Charleston, SC
Chattooga River Coalition - Clayton, Georgia
Chief Bureau of Forest RES & Economy - Tallahassee, Florida
Chipola Land Timber - Blountstown, FL
Circuit Court Clerk - Smith County, MS
Clairborne Parish School Board - Homer, Louisiana
Commission of Forestry - Columbia, SC
Commissioner of Agriculture - Baton Rouge, Louisiana
Conservation Council of N. C. - Durham, North Carolina
Conservation Committee - Knoxville, Tennessee
Conway Pole & Piling Co., Inc. - New Augusta, MS
Cooperative Extension Service - Rolling Fork, MS
Corbin Tourist & Convention Commission - Corbin, Kentucky
Corps of Engineers - Vicksburg, MS
Corps of Engineers - Camden, AL
Corrigan Times - Corrigan, Texas
Coastal Lumber Company - Walterborc, SC
Coastal Lumber Company - Havanna, FL
County Forester - Troy, North Carolina
Craven County Chamber of Commerce - New Bern, North Carolina
DA HQ USATC & FT Jackson - Ft. Jackson, SC
Delotelle, Gurther, Inc. - Gainesville, Florida

AGENCIES/BUSINESSES/ORGANIZATIONS - continued

Delta Conservation League - Delta City, MS
DENDROI - Douglasville, Georgia
Dennis Wildlife Center - Bonneau, SC
Department of Forest Service - College Station, Texas
Dept of Env. Health - Raleigh, NC
Dept of WL Conservation - Oklahoma City, OK
Dept. Fish & Wildlife Resources - Frankfort, Kentucky
Dept. of Wildlife and Fisheries - Baton Rouge, Louisiana
Dept. of Forestry, WL, & Fisheries - Knoxville, Tennessee
District Conservationist, NRCS - Somerset, Kentucky
Division of Boating and Inland Fisheries - Raleigh, North Carolina
Division of Wildlife Management - Raleigh, North Carolina
Division of Forestry - Frankfort, Kentucky
Division of Marine Fisheries - Washington, North Carolina
Division of Parks & Recreation - Raleigh, North Carolina
Division of Forestry - Tallahassee, FL
DOE Environmental Division - Aiken, SC
Dulaney Law Firm - Tunica, MS
Eastern Area Counsel Office - Camp Lejeune, NC
ECO-MS - Jackson, MS
EHNR Regional Office - Winston-Salem, North Carolina
EKU, Division of Natural Areas - Richmond, Kentucky
Enterprise Journal - McComb, MS
Environmenta Office Biologist - FT. Polk, Louisiana
Environmental Defense Fund - Washington, DC
Environmental Quality Comm. - Frankfort, Kentucky
EPA/EIS Rev Coordinator - Dallas, Texas
EPA Environmental Policy Section - Atlanta, Georgia
Espey Houston & Associates - Austin, Texas
Extension Service - Stillwater, OK
Fayette Observer - Fayetteville, SC
Fed HWY Administration - Sterling, VA
Federal Paper Board - Augusta, Georgia
Federal Highway Administration - Atlanta, Georgia
Feldman Lumber Co., Inc. - Lancaster, KY
FERC - Washington, DC
FHWA Eastern FED Lands HWY EV - Sterling, VA
Fish & Wildlife Service - Arlington, Texas
FL Regional Office of TNC - Winter Park, Florida
FL Game & Fresh Water Fish Comm - Tallahassee, FL
Florida Audubon Society - Casselberry, Florida

AGENCIES/BUSINESSES/ORGANIZATIONS - continued

Florida Dept. of Natural Resources - Tallahassee, Florida
Florida Audubon Society - Casseleberry, FL
Florida Dept. of Environmental Protection - Tallahassee, Florida
Florida Forestry Association - Tallahassee, Florida
Florida Dept. of Environ. Protection - Tallahassee, Florida
Florida Game and Fresh Water Com. - Lake City, Florida
Florida Defenders of Environment - Gainesville, Florida
Florida Division of Forestry - Tallahassee, Florida
Florida Woodlands, Georgia-Pacific Corp. - Palatka, Florida
Florida Forestry Services Co - Gainesville, Florida
Florida Department of Community Affairs - Tallahassee, Florida
Florida Game and Fresh Water Com. - Ocala, Florida
Florida State Clearinghouse - Tallahassee, Florida
Florida Wildlife Federation - Tallahassee, Florida
Florida Game & Fresh Water Fish Commission - Panama City, Florida
Florida Chapter, Wildlife Society - Tallahassee, FL
Forest Resources Division - Taylorsville, MS
Forest Landowners Association - Alexandria, Kentucky
Forestry Resources, Griffiths Forestry Ctr. - Clayton, North Carolina
Forestwatch - TWS - Atlanta, Georgia
Frank G. Lake Lumber Co - Monticello, Georgia
Franklin Timber Company - Bude, MS
Franklin County BD of Commissioners - Apalachicola, Florida
Friends of Appalachicola - Tallahassee, FL
Friends of the Mountains - Clarkesville, Georgia
Friendswood Development CO - Houston, Texas
G&G Forestry Associates Inc. - Biloxi, MS
GA St. Clearinghouse - Atlanta, Georgia
GA Council of Trout Unlimited - Stone Mountain, Georgia
GA Dept. of Natural Resources - Gainesville, Georgia
GA - DNR - Atlanta, Georgia
GA Pacific Corp. East Central Regional Office - Jackson, MS
GA Forestry Commission - Macon, Georgia
GA Botanical Society - Atlanta, Georgia
Georgia Pacific Corporation - New Augusta, MS
Georgia Pacific - Talorsville, MS
Georgia Pacific - Decatur, Georgia
Georgia Pacific Corporporation - Grenada, MS
Georgia Pacific Corporation - Monticello, MS
Georgia Pacific - Russellville, SC
Georgia Appalachian Trail Club - Atlanta, Georgia
Georgia Wildlife Federation - Conyers, Georgia

AGENCIES/BUSINESSES/ORGANIZATIONS - continued

Georgia-Pacific Corp. - Monticello, Georgia
Georgia DOT - Atlanta, Georgia
Georgia Conservancy - Atlanta, Georgia
Golden Triangle Sierra CLub - Batson, Texas
Gopher Tortoise Council - Tallahassee, Florida
Governor, Columbia South Carolina - Columbia, SC
GP Corp. - Madison, Georgia
Grant Parish School Board - Colfax, Louisiana
Grant Parish Police Jury - Colfax, Louisiana
Green County Mississippi - Leaksville, MS
Gulf States Paper Corp - Tuscaloosa, AL
Gulf Coast Regional Conservation Committee - Ocean Springs, MS
Gulf Engineers & Consultants - Baton Rouge, LA
Gulf Forestry Assoc. - Hattiesburg, MS
Gulf Lumber Company, Inc. - Mobile, AL
GVK America, Inc. - Biscoe, North Carolina
Haliburton Nus Envir Corp - Aiken, SC
Hancock Lumber & Forest Products, Inc. - Mize, MS
Hand Arendall Attorneys - Mobile, AL
Hankins Lumber Company, Inc. - Grenada, MS
Hercules Inc. - Tallahassee, Florida
Hester, Stockett & Thomas - Jackson, MS
Houston Audubon Society - The Woodlands, Texas
Houston Advanced Research Center - The Woodlands, Texas
Hunt Plywood Co., Inc. - Ruston, Louisiana
Institute for Coastal & Marine Resources - Greenville, North Carolina
International Paper - Hattiesburg, MS
International Paper - Morton, MS
International Paper Company - Georgetown, SC
International Paper Co. - Natchez, MS
International Paper Company - Pineville, Louisiana
International Paper Company - Bainbridge, Georgia
ITT Rayonier Inc. - Waycross, Georgia
Izzack Walton League - Swansboro, North Carolina
Jackson Audubon Society - Jackson, MS
Jasper County Board of Supervisors - Bay Springs, MS
Jeff Glitzenstin/Donna Strung - Mt. Pleasant, SC
Keadle Treating, Inc. - Thomaston, Georgia
Keep Kisatchie Coalition - Shreveport, Louisiana
Kentuckians for the Commonwealth - Prestonburg, KY 41653
Kentucky State Nature Preserves Comm. - Frankfort, Kentucky
Kentucky Horse Council - Owingsville, Kentucky
Kentucky Dept. for Env. Protection - Frankfort, Kentucky
Kentucky Resources Council - Frankfort, KY
Kentucky Native Plant Society - Richmond, Kentucky
Kentucky Farm Bureau Federation - Louisville, Kentucky

AGENCIES/BUSINESSES/ORGANIZATIONS - continued

Kentucky Conservation Committee - Louisville, Kentucky
Kentucky Chapter The Wildlife Society - Lexington, Kentucky
Kentucky Resources Council - Frankfort, Kentucky
Kentucky Audubon Council - Owensboro, Kentucky
Kentucky Forest Industries Assoc. - Frankfort, Kentucky
Kentucky Dept. for Natural Resources - Frankfort, Kentucky
Kentucky Ornithological Society - Richmond, Kentucky
KY Heartwood - Frankfort, KY
KY Dept of Fish & Wildlife Resources - Frankfort, KY
KY State Nature Preserves Commission - Frankfort, KY
L. C. White Forest Consultant Services - Greenville, MS
L.L. Brewton Lumber Company - Winnfield, Louisiana
LA Dept of WL & Fisheries - Baton Rouge, LA
LA Wildlife Federation - Baton Rouge, Louisiana
LA SAF - Hodge, Louisiana
LA Department of Agriculture & Forestry - Baton Rouge, Louisiana
LA Wild Turkey Federation - DeRidder, Louisiana
LA Natural Heritage Program - Baton Rouge, Louisiana
LA Nature Conservancy - Baton Rouge, Louisiana
LA Wild Turkey Federation - Delhi, Louisiana
LA Wild Turkey Federation - Pineville, Louisiana
LA Forestry Asociation - Alexandria, LA
LA Wildlife Biologist Association - Marrera, Louisiana
Lafayette Nature History Museum - Lafayette, Louisiana
Lambs Realty & Forestry - Independence, MS
Lape Fiberglass, Inc. - Pascagoula, MS
League of Kentucky Sportsman - Russell Springs, Kentucky
League of Kentucky Sportsman, Inc. - Butler, Kentucky
Leesville Lumber Company - Leesville, Louisiana
Lexington Herald-Leader - Lexington, Kentucky
Louisiana Forestry Association - Alexandria, Louisiana
Liberty County Board of Commissioners - Bristol, Florida
Liberty Weekly Journal - Bristol, Florida
Liles Forest Management Inc. - Walterboro, SC
Lone Star Chapter Sierra Club, Austin, Texas
Lone Star Chapter Sierra Club - Huntsville, Texas
Lone Star Sierra Club #2071 - Houston, Texas
Longmire Gravel, Inc. - Crosby, MS
Louisiana Trail Riders Association - Roseland, Louisiana
Louisiana Deerhunters Association - Woodworth, Louisiana
Louisiana Office of Forestry - Baton Rouge, Louisiana
Louisiana Pacific Corp. - Crestview, FL
Louisiana Audubon Council - Baton Rouge, Louisiana
Louisiana-Pacific Corporation - Urania, Louisiana

AGENCIES/BUSINESSES/ORGANIZATIONS - continued

Louisiana Native Plant Society - Saline, Louisiana
Louisiana Forestry Association - Ruston, Louisiana
Louisville Audubon Society - Louisville, Kentucky
Leaf River WMA, Area Manager - Wiggins, MS
Lucy Braun Association - Lexington, Kentucky
Maersk Energy Inc. - Houston, Texas
Managers St. Marks National Wildlife Refuge - St. Marks, Florida
Manville Corp. - Washington, DC
Marion County BD of Commissioners - Ocala, Florida
McCreary County Forest Industries Assoc. - Pine Knot, Kentucky
McDowell Park - Charlotte, NC
McFarlane & Associates - Houston, Texas
Metcalf Lumber Company - Thomasville, Georgia
Mississippi Forestry Commission - Jackson, MS
Mississippi Lumber Manufacturers Assoc. - Jackson, MS
Mississippi Chemical Corporation - Yazoo City, MS
Montgomery County Econcomi Development Corp. - Troy, North Carolina
Montgomery County Board of Commissioners - Troy, North Carolina
Montgomery County School Board - Troy, North Carolina
Montgomery County Agriculture Extension - Troy, North Carolina
MOTSU - Southport, NC
Mountain City Lumber Company - Laurel Bloomery, TN
MS Federal Timber Council - Jackson, MS
MS Natural Heritage Program - Jackson, MS
MS Dept. W/L Fisheries & Parks - Jackson, MS
MS Department of Wildlife, Fish/Parks - Jackson, MS
MS Board of Choctaw Indians - Philadelphia, MS
MS Dept. of Archives & History - Jackson, MS
MS Forestry Association - Jackson, MS
MS Soc of American Foresters - Hattiesburg, MS
MS Wildlife Federation - Jackson, MS
MS Extension Forestry, Mississippi State, MS
MS Federal Timber Council - Jackson, MS
MS Forestry Association - Jackson, MS
MS Wildlife Federation - Jackson, MS
MS Forestry Commission - Forest, MS
MS Tourism & Development Division - Jackson, MS
MS Manufacturers Assn. - Jackson, MS
MS Museum of Natural Science - Jackson, MS
MS Dept. W/L Fisheries & Parks - Jackson, MS
MS Chapter Sierra Club - Canton, MS
MSARNG-Facilities Management Office - Jackson, MS
Multi-Use Forest Assoc of SE - Chattanooga, Tennessee
N.C. Wildlife Society - Raleigh, North Carolina

AGENCIES/BUSINESSES/ORGANIZATIONS - continued

N.C. Wildlife Resources Commission - Pollocksville, North Carolina
N.C. Division of Parks & Recreation - Raleigh, North Carolina
N.C. Division of Coastal Mgt. - Raleigh, North Carolina
N.C. Wildlife Resources Commission - New Bern, North Carolina
N.C. Trail Riders Association - Greensboro, North Carolina
N.C. WRC-Div. of Environ., Mgmt., - Raleigh, North Carolina
N.C. DEHNR/Div. of Env. Mgt. - Raleigh, North Carolina
N.C. Trails Association - Waynesville, North Carolina
N.C.W.R.C. - Chocowinity, North Carolina
NAS Oceana - Virginia Beach, VA
Natchez Adams School District - Natchez, MS
Natchitoches Parish Police Jury - Natchitoches, Louisiana
Natchitoches Parish School Board - Natchitoches, Louisiana
Natchitoches Audubon Society - Natchitoches, Louisiana
National Audubon Society, Tallahassee, Florida
National Park Service - Beaumont, Texas
National Wildlife Federation - Ellerbe, North Carolina
National Wild Turkey Federation - New Bern, North Carolina
National Wild Turkey Federation - Randleman, North Carolina
National Park Service - Santa Fe, NM
National WL Federation, Inc. - Atlanta, Georgia
National Wildlife Federation - Raleigh, North Carolina
Natural Hazards Branch - Atlanta, Georgia
NC Forestry Assn Inc. - Raleigh, NC
NC Plant Conservation Program - Raleigh, North Carolina
NC Nature Conservancy - Chapel Hill, North Carolina
NC Multiple Use Council - Sylva, North Carolina
NC Division of Forest Resources - New Bern, North Carolina
NC State Forest Service - Troy, North Carolina
NC Nature Conservancy - Carrboro, North Carolina
NC Division of Forest Resource - Raleigh, NC
NCASI - New York, NY
NCWRC Non-Game Species Division - Raleigh, North Carolina
NCWRC - Burlington, North Carolina
Neuse River COG - New Bern, North Carolina
Neuse River Foundation - New Bern, North Carolina
Newport Rotary Club - Newport, North Carolina
NLA SAF Group - Jonesboro, Louisiana
NOHVCC - Carencro, Louisiana
North Carolina Wildlife Resources - New Bern, North Carolina
North Carolina Natural Heritage Program - Raleigh, North Carolina
North Florida Lumber Inc - Bristol, FL

AGENCIES/BUSINESSES/ORGANIZATIONS - continued

North Pike Public Schools - Summit, MS
North Carolina Wildlife Federation - Raleigh, North Carolina
North Carolina State Forest Service - Raleigh, North Carolina
North American Resource Manager - Charlottesville, VA
North Carolina Wildlife Resources Comm. - Raleigh, North Carolina
Northwest Florida Water Mgmt. Dist. - Havana, Florida
Noxubee National WL Refuge - Brooksville, MS
NPS Office of Communication - Sante Fe, New Mexico
Nuckols Farm - Nidway, KY
NWTF - Edgefield, SC
NY State Dept-Environ Conser Wildlife Resourses Cntr - Delmar, NY
O. T. Wallace Co Office Bldg. - Charleston, SC
Office of Federal Grant Mgmt. - Jackson, MS
Office of General Council - Temple, Texas
Okefenokee National WL Refuge - Folkston, Georgia
Oklahoma Wildlife Federation - Oklahoma City, OK
Oktibbeha Audubon Society - Starkville, MS
Ouachita NF Timbers Purchasers Group - Russellville, AR
PBS Lumber Mfg., Inc. - Winnfield, Louisiana
Perry County Board of Supervisors - New Augusta, MS
Perry County Schools - New Augusta, MS
PHPPO (E20) - Atlanta, Georgia
Piedmont Mining Co. - Charlotte, North Carolina
Piedmont Seirra Club - Charlotte, North Carolina
Pineywoods SAF - Natchitoches, Louisiana
Planning/Design Resources - Pawleys Island, SC
Planning Dept of Berkeley - Monks Corner, SC
Price Services - Monticello, AR
Progress Wood - Osyka, MS
Provine Helicopter Service - Greenwood, MS
Public Awareness Comm., Inc. - Fort Smith, AR
Quail Unlimited - Pineville, Louisiana
Quail Unlimited - Winnfield, Louisiana
Quail Unlimited of Carteret County - Newport, North Carolina
Quail Unlimited of Carteret County - Emerald Isle, North Carolina
Quail Unlimited, Inc. - Nancy, Kentucky
Rabun County Coalition - Clayton, Georgia
Rapides Parish School Board - Alexandria, Louisiana
Rapides Parish Police Jury - Pineville, Louisiana
Rapides Parish Police - Boyce, Louisiana
Riverwood International - West Monroe, Louisiana
Rollins Pulpwood & Timber Co. - Centervillle, MS
Roy O. Martin Lumber Co., Inc. - Alexandria, Louisiana
Ruffed Grouse Society - Clayton, Georgia
Rust Envir & Infrastructure - Greenville, SC
San Jac City Wilderness Club - Cleveland, Texas
Sandhills Chapter, Society of American Foresters - Rockingham, North Carolina

AGENCIES/BUSINESSES/ORGANIZATIONS - continued

Santee Cycle Club - Holly Hill, SC
SC Wildlife & Marine Resources Department - Columbia, SC
SC Forestry Commission - Patrick, SC
SC Forestry Commission - Columbia, SC
SC Forestwatch - Westminister, South Carolina
SC Dept of Natural resources - Columbia, SC
SC Forestry Association - Columbia, SC
SC Wildlife Federation - Columbia, SC
SC Coastal Conservation League - Charleston, SC
SC Institute of Archeology - Columbia, SC
SC Coastal Council - Charleston, SC
SC Dept. Health & Env Com. - Columbia, SC
SC Dept. of Arch & Hist - Columbia, SC
SC Nature Conservancy - Columbia, SC
SC Water Resources Comm. - Columbia, SC
Scott County Board of Supervisors - Forest, MS
SE Forest Fire Lab - Dry Branch, Georgia
SE Texas Off Road Roders - Bridge City, Texas
SE LBR Manu Assn., Inc. - Forest Park, Georgia
Senate Committee/Environment & Public Works - Washington, DC
Sierra Club SE Office - Birmingham, AL
Sierra Club - Lake City, FL
Sierra Club, Bluegrass Group - Lexington, Kentucky
Sierra Club Legal Defense Fund - Tallahassee, Florida
Sierra Club Legal Defense Fund - Dozeman, Montana
Sierra Club, North Carolina Chapter - Raleigh, North Carolina
Sierra Club/GA Chapter - Decatur, Georgia
Sierra Club, Cypress Chapter - Greenville, North Carolina
Sierra Club Legal Defense Fund - Bozeman, MT
Sierra Club - Lake City, Florida
Sierra Club - Pollock, LA
Sierra Club Cumberland Chapter - Lexington, Kentucky
Sierra Club, Ouachita Group - Ruston, Louisiana
Sierra Club Legal Defense Fund, Inc - New Orleans, LA
SIS Review Coordinator EPA Region VI - Dallas, Texas
Sizemore & Sizemore Inc. - Tallahassee, FL
Smith County Board of Supervisors - Raleigh, MS
SO Environmental Law Center - Chapel Hill, NC
Society of American Foresters - Bethesda, MD
Society of American Foresters, MS Chapter - Hattiesburg, MS

AGENCIES/BUSINESSES/ORGANIZATIONS - continued

Soil Conservation Service - Raleigh, North Carolina
Soil Conservation Service - New Bern, North Carolina
Soil Conservation Services - Temple, Texas
Somerset/Pulaski Co. CBR of Comm. - Somerset, Kentucky
Soule' Steam Feed Works - Meridian, MS
South Paw - Chapel Hill, North Carolina
South Alabama Regional Planning Commission - Mobile, AL
Southeastern Forest Experiment Station - RTP Raleigh, North Carolina
Southern Appalachian Biodiversity Project - Asheville, North Carolina
Southern Forest Products Assoc. - Kenner, LA
Southern Resource Service - Starkville, MS
Southern Timber Purchasers Council - Atlanta, Georgia
Southern Land Management, Inc. - Bay Springs, MS
Southern Resource Service, Inc. - Starkville, MS
Southern Hardwoods Lab - Stoneville, MS
Southern Forest Experiment Station - Nacogdoches, Texas
Southern Lumber Company, Inc. - Hermanville, MS
Southgate Timber Co. - Hattiesburg, MS
Southwest Florida Water Mgmt. Dist. - Brooksville, Florida
St. Johns Water Mgmt. Dist. - Palatka, Florida
State Clearinghouse - Raleigh, North Carolina
State of North Carolina - Raleigh, NC
State Forester, Louisiana - Baton Rouge, Louisiana
Stone Container - Orangeburg, SC
Stone Container Corp. - Hodge, Louisiana
Stuart Brothers Inc. - Hattiesburg, MS
Supt. of Education, Adams Co. - Natchez, MS
Supt. of Education, Amite Co. - Liberty, MS
Supt. of Education, Franklin Co. - Meadville, MS
Supt. of Education, Jefferson Co. - Fayette, MS
Supt. of Education, Perry Co. - New Augusta, MS
Supt. of Education, Stone Co. - Wiggins, MS
Supt. of Education, Lincoln Co. - Brookhaven, MS
Supt. of Education, Harrison Co. - Ocean Springs, MS
Supt. of Education, Forrest Co. - Hattiesburg, MS
Supt. of Education, Newton Co. - Decatur, MS
Supt. of Education, Jones Co. - Ellisville, MS
Supt. of Education, Pearl River Co. - Poplarville, MS
Supt. of Education, Smith Co. - Raleigh, MS
Supt. of Education, Harrison Co. - Gulfport, MS
Supt. of Education, Wilkinson Co. - Woodville MS
Supt. of Education, Scott Co. - Forest, MS
Supt. of Education, Copiah Co. - Hazlehurst, MS
Supt. of Education, Wayne Co. - Waynesboro, MS
Surgical Technology - Vicksburg, MS
Suwannee River Water Mgt. Dist - Live Oak, Florida
SWLA SAF Group - DeRidder, Louisiana
T. F. Evans Lumber Co., Inc. - Fulton, MS

AGENCIES/BUSINESSES/ORGANIZATIONS - continued

T.L. James & Company, Inc. - Mora, Louisiana
T&S Hardwoods - Sylva, North Carolina
Tall Timbers - Tallahassee, Florida
TCONR - Dallas, Texas
Temple-Inland - Diboll, Texas
Texas Forest Service - College Station, Texas
Texas Organization/Endangered Species - Austin, Texas
Texas Parks & Wildlife Dept. - Austin, Texas
Texas Recreation & Park Service - Austin, Texas
Texas Farm Bureau - Waco, Texas
Texas Parks & W/L Dept - Victoria, Texas
Texas Organization End. Species - Austin, Texas
Texas Parks & Wildlife Service - Lufkin, Texas
Texas Parks & Wildlife Dept. - Nacogdoches, Texas
Texas Farm Bureau - Lufkin, Texas
The Wilderness Society - Atlanta, Georgia
The Nature Conservancy - Lexington, KY
The Nature Conservancy - Jackson, MS
The Wilderness Society - Washington, DC
The Nature Conservancy - Silsbee, Texas
The Adjutant General's Office - Jackson, MS
The Nature Conservancy - Tallahassee, Florida
The Foundation for Global Sustainability - Asheville, North Carolina
The Nature Conservancy - Atlanta, Georgia
The Wildlife Connection - Munfordville, Kentucky
The Nature Conservancy - Fort Benning, Georgia
The Nature Conservancy - Chappel Hill, NC
The Nature Conservancy - Silsbee, Texas
The Wildlife Society, NC Chapter - Raleigh, North Carolina
Thrift Brothers Timber Co. - Westminister, South Carolina
Timber Purchasers Council - Atlanta, Georgia
Time to Be Saved - Morganton, SC
TN Wildlife Res. Agency - Nashville, Tennessee
TN Division of Forestry - Nashville, Tennessee
TN Conservation League - Nashville, Tennessee
TN Dept. of Environment & Conservation - Nashville, Tennessee
TN Forestry Assoc. - Nashville, Tennessee
TN Nature Conservancy - Nashville, Tennessee

AGENCIES/BUSINESSES/ORGANIZATIONS - continued

Trail Riders of Houston - Houston, Texas
Trust for Public Land - Tallahassee, Florida
Turner-Collie-Braden - Houston, Texas
TVA - Land Between the Lakes - Murray, Kentucky
TVA, Land Between the Lakes - Golden Pond, Kentucky
TVA - Dept. Natural Resources - Knoxville, Tennessee
TX Committee - Natural Resources - Dallas, Texas
U.S. Fish & Wildlife Service - Vicksburg, MS
U.S. Fish & Wildlife Service - Daphne, AL
U.S. Department of Interior - Brooksville, MS
U.S. Fish & Wildlife Service - Jackson, MS
U.S. Fish & Wildlife Service - Mississippi State, MS
U.S. Fish & Wildlife Enhancement Office - Raleigh, North Carolina
U.S. Army Corps of Engineers - Washington, DC
U.S. Dept of the Unterior - Brunswick, Georgia
U.S. Fish & Wildlife Service - Brunswick, Georgia
U.S. Fish & Wildlife Service - Atlanta, Georgia
U.S. Environmental Protection Agency - Atlanta, Georgia
U.S. Fish & Wildlife Service, Tech. Asst. Div. - Raleigh, North Carolina
U.S. Bureau of Mines, IFOC - Denver, CO
U.S. Fish & Wildlife Service - Lafayette, Louisiana
Union Public School District - Union, MS
Union Camp Corporation - Savannah, Georgia
Urban League of Arkansas - Little Rock, AR
URS Consulttants - Metairie, LA
U.S. Fish & Wildlife Service - Clemson, SC
U.S. Fish & Wildlife Service - Gainesville, Florida
U.S. Fish & Wildlife Service - Panama City, Florida
U.S. Fish & Wildlife Service - Cookeville, TN
U.S. Fish & Wildlife Service - Jacksonville, Florida
U.S. Fish & Wildlife Service - Houston, Texas
U.S. Army Inventory Center - Fort Benning, Georgia
U.S. Fish & Wildlife Service - Asheville, NC
U.S. Fish & Wildlife Service - Raleigh, North Carolina
USASC & FG - Ft Gordon, Georgia
USDA SE Forest Experiment Station - Charleston, SC
USDA Soil Conservation Service - Asheboro, North Carolina

AGENCIES/BUSINESSES/ORGANIZATIONS - continued

USDA Environmental Ecol Sciences Division - Washington, DC
USDA -OGC-Natural Res. Div. - Washington, DC
USDA Forest Service - Hemphill, Texas
USDI Geological Servey, WRD - Columbia, SC
USDI-Fish & Wildlife Service - Albuquerque, NM
Uwharrie Trail Club - Asheboro, North Carolina
Vernon Parish School Board - Leesville, Louisiana
Vernon Parish Police Jury - Leesville, Louisiana
VPI Forestry Department - Blacksburg, VA
VPI & SU - Blacksburg, VA
W.Clairborne Parish Police Jury - Homer, Louisiana
Waccamaw Audubon Society - Myrtle Beach, SC
Wakulla County BD of Commissioners - Crawfordville, Florida
Wayne County Board of Supervisors - Waynesboro, MS
Webster Parish School Board - Minden, Louisiana
West Union Hardware, Inc. - West Union, South Carolina
Western Line Schools Superintendent - Avon, MS
Westinghouse - Savannah River - Aiken, SC
WESTVACO Corporation - Summerville, SC
Wettanda Ecological Services - Mandeville, LA
Weyerhaeuser Company - Columbus, MS
Weyerhaeuser Company - New Bern, North Carolina
Wilderness Watch - Missoula, MT
Wilderness Society - Coral Gables, Florida
Wildlife - Northside, North Carolina
Wildlife Wood Carving - Ravenna, KY
Wildlife Management Institute Southeastern Rep. - Lawrenceburg, TN
Wildlife Management Institute - MS
Wilkerson & Crawford, Attorneys at Law - Woodville, MS
Willamette Industries, Dodson, Louisiana
Willamette Industries, Inc. - Ruston, LA
Winn Parish School Board - Winnfield, Louisiana
Winn Parish Police Jury - Winnfield, Louisiana
WL Soc. Envir. Affairs Comm - Mississippi State, MS
WL Rehab Nature Center Inc. - Natchez, MS
Yadkin, Inc. - Badin, North Carolina
Young Estate - Campti, LA
Zel Engineers - Augusta, Georgia

UNIVERSITIES

A

Alcorn State University - Lorman, MS
AT&T State University - Greensboro, North Carolina
Auburn University, School of Forestry - Auburn, AL
Auburn University - Auburn, AL

C

CGR University of Florida - Gainesville, Florida
Clemson University, SEFES - Clemson, SC
Clemson University, Dept. of Forestry - Clemson, South Carolina
Clemson University - Clemson, South Carolina
Clemson University, NCASI Dept of AFW - Clemson, SC
College of Charleston/Biology - Charleston, SC
Colorado State University - Fort Collins, CO
Copiah-Lincoln Community College - Wesson, MS

D

Dept. of Biological Sciences - Tallahassee, Florida
Dept. of Wildlife & Range Science - Gainesville, Florida

E

Eastern Kentucky University - Richmond, KY

F

Florida State University - Tallahassee, Florida
Florida A&M University - Tallahassee, FL
Fort Valley State College - Ft. Valley, Georgia

J

Jackson State University - Jackson, MS
Jones Community College - Ellisville, MS

UNIVERSITIES - continued

K

Kentucky State University - Frankfort, Kentucky

L

Lake City Community College - Lake City, Florida
Louisiana State University, School of Forestry - Baton Rouge, LA

M

Mississippi State Univ, Dept. of Wildlife & Fisheries - Miss State, MS
Mississippi State Univ, School of Forest Resources - Miss State, MS
Mississippi State Univ, Dept. of Biological Science - Miss State, MS
Mississippi Gulf Coast Community College - Perkinston, MS

N

National Ctr for Agri Law - Fayetteville, AR
NC State University, Dept of Forestry - Raleigh, NC
NC State University, Dept of Zoology - Raleigh, NC
Northern Kentucky University - Highland Heights, KY
Northwestern University - Evanston, IL
NSU Dept of Biology - Natchitoches, LA
NW State University - Natchitoches, LA

O

OFASU College of Forestry - Nacogdoches, Texas

R

Rice University - Houston, Texas

S

Sam Houston State University - Huntsville, Texas
School of Forestry at University of Florida - Gainesville, Florida

UNIVERSITIES - continued

Somerset Community College - Somerset, Kentucky
State University of New York - Plattsburgh, NY
Stephen F. Austin University, College of Forestry - Nacogdoches, Texas

T

Texas A&M University - College Station, Texas
Texas A&M University, Dairy Science Bldg - College Station, Texas

U

Univ of New Orleans, Dept. of Biological Science - New Orleans, Louisiana
University of N. C., School of Geology - Chapel Hill, North Carolina
University of Southern Mississippi - Hattiesburg, MS
University of Houston Law Center - Houston, Texas
University of New Mexico - Albuquerque, NM
University of Georgia, School of Forestry - Athens, Georgia
University of Arkansas, Biological Sciences - Fayetteville, AR
University of Arkansas - Monticello, AR
University of Florida, Dept of Botany - Gainesville, FL
University of Washington, Seattle, WA
University of Wisconsis-Madison - Madison, WI
University of Tennessee, Dept. of Forestry - Knoxville, Tennessee
University of Louisville - Louisville, Kentucky
University of Kentucky, Dept. of Zoology - Lexington, Kentucky
University of Florida - Gainesville, Florida
University of Kentucky, Dept of Forestry - Lexington, KY
Utah State University - Logan, Utah

V

VA Tech - Blacksburg, VA

W

West Georgia College, Biology Dept - Carrollton, Georgia

LIBRARIES

Alcorn State University Library - Lorman, MS

Bay Springs Municipal Library - Bay Springs, MS
Bay County Public Library - Panama City, Florida
Benton County Library System - Ashland, MS
Blazer Library - Frankfort, Kentucky
Broward County Public Library - Ft. Lauderdale, Florida
Bude Public Library - Bude, MS

Carl S. Swisher Library - Jacksonville, Florida
Central Brevard Public Library - Cocoa, Florida
Central Florida Regional Library - Ocala, Florida
Central Mississippi Regional Library - Pearl, MS
Charleston County Library - Charleston, SC
Choctaw County Library - Ackerman, MS
Clay Co. Public Library - Manchester, Kentucky
Coffeeville Public Library - Coffeeville, MS
Copiah-Lincoln College Library Wesson, MS
Corbin Public Library - Corbin, Kentucky
Crockett Public Library - Crockett, Texas

Dallas Public Library - Dallas, Texas
Decatur Public Library - Decatur, MS
Documents Dept/Libraries Colorado St. Univ. - Fort Collins, CO
Dupont-Ball Library - Deland, Florida

Eagle Creek Library - Lexington, Kentucky
Ekstrom Library - Louisville, Kentucky
Eudora Welty Library - Jackson, MS

Florida Dept. of State Library, Tallahassee, Florida
Florida State University Library - Tallahassee, Florida
Floyd J. Robinson Memorial Library - Raleigh, MS
Forest Public Library - Forest, MS
Forest Resources Library AQ-15 - Seattle, WA
Franklin County Public Library - Meadville, MS

George W. Covington Memorial Library - Hazelhurst, MS
Gloster Public Library - Gloster, MS
Gulfport-Harrison County Library - Gulfport, MS

H.T. Sampson Library - Jackson, MS
Holmes Community College - Grenada, MS
Houston Carnegie Library - Houston, MS
Houston Public Library - Houston, Texas

J. G. Grabbe Library EKU - Richmond, KY

LIBRARIES - continued

J.R. Huffman Public Library - Hemphill, Texas
Jacksonville Public Library - Jacksonville, Florida
Jane Bancroft Cook Library, Sarasota, Florida
Jefferson County Public Library - Fayette, MS
Jennie Stephens Smith Library - New Albany, MS
John Davis Williams Library UM - University, MS
John Pace Library - Pensacola, Florida
John F. Kennedy Memorial Public Library - West Liberty, Kentucky
Jones Community College Library - Ellisville, MS
Judge George W. Armstrong Library - Natchez, MS

Kurth Memorial Library #377 - Lufkin, Texas

Laura Doyle, Epic Library - Frankfort, Kentucky
Laurel-Jones County Library - Laurel, MS
Laurel Co. Public Library - London, Kentucky
Leaksville Public Library - Leaksville, MS
Lee Co. Public Library - Beattyville, Kentucky
Lee County Library - Ft. Myers, Florida
Leon County Public Library - Tallahassee, Florida
Liberty Public Library - Liberty, MS
Lincoln County Library - Brookhaven, MS
Lucedale-George County Library - Lucedale, MS

Marshall County Library - Holly Springs, MS
McCreary Co. Public Library - Whitley City, Kentucky
Mitchell Memorial Library, MS State UN - Mississippi State, MS
Montgomery County Library - Monroe, Texas
Morton Public Library - Morton, MS
MS Gulg Coast Comm. College Library - Perkinston, MS

New Augusta Public Library - New Augusta, MS
North Miami Campus Libary - North Miami, Florida
NW Regional Library - Panama City, Florida

Orange County library - Orlando, Florida
Oxford Public Library - Oxford, MS

Pascagoula Public Library - Pascagoula, MS
Ponotoc Public Library - Ponotoct, MS
Poplarville Public Library - Poplarville, MS

Richland Co. Public Library - Columbia, SC
Richton Public Library - Richton, MS
Ripley Public Library - Ripley, MS
Rockcastle Co. Public Library - Mt. Vernon, Kentucky

S.J. & Jessie E. Quinney Natural Resources Library - Logan, Utah

LIBRARIES - continued

Science Library, University of Georgia - Athens, Georgia
SFASU Steen Library - Nacogdoches, Texas
SFRC Library - Hot Springs, AR
Sharkey-Issaquena County Library - Rolling Fork, MS
St. Petersburg Public Library - Saint Petersburg, Florida
Starkville Public Library - Starkville, MS
Steely Library NKU - Highland Heights, KY
Stone County Library - Wiggins, MS

Tall Timbers Research Inc. Library - Tallahassee, Florida
Tamiami Campus Library - Miami, Florida
Texas Legislative Reference Library - Austin, Texas
Texas Forest Service Library - College Station, Texas
The Library of Hattiesburg, Petel & Forrest Co. - Hattiesburg, MS
The Library - Monticello, AR

University Of Texas Library - Austin, Texas
University of Miami Library - Coral Gables, Florida
University of Central Florida Library - Orlando, Florida
USDA National AG Library - Beltsville, MD
USM Cook Library - Hattiesburg, MS

Volusia County Library - Daytona Beach, Florida

Warren County-Vicksburg Library - Vicksburg, MS
Waynesboro Memorial Library - Waynesboro, MS
West Palm Beach Public Library - West Palm Beach, Florida
Whitley Co. Public Library - Williamsburg, Kentucky
Winston County Library - Louisville, MS
Woodville Public Library - Woodville, MS

US FOREST SERVICE OFFICES

Andrew Pickens RD - Mt. Rest, SC
Angelina RD - Lufkin, TX
Appalachicola RD - Bristol, FL
Armuchee RD - Lafayette, GA

Bankhead RD - Double Springs, AL
Bayou RD - Hector, AR
Berea RD - Berea, KY
Bienville National Forest, Strong River RD - Raleigh, MS
Bienville National Forest, Bienville RD - Forest, MS
Bienville RD - Forest, MS
Biloxi RD - McHenry, MS
Black Creek RD - Brooklyn, MS
Blacksburg RD - Blacksburg, VA
Boston Mountain RD - Ozark, AR
Brasstown RD - Blairsville, GA
Bude RD - Meadville, MS
Buffalo RD - Jasper, AR

Caddo-LBJ National Grasslands - Decatur, TX
Caddo RD - Glenwood, AR
Caney RD - Homer, LA
Catahoula RD - Bently, LA
Catalina Work Center - Palmer, PR
Chattooga RD - Clarkesville, GA
Cheoah RD - Robbinsville, NC
Chestatee RD - Dahlonega, GA
Chickasawhay RD - Laurel, MS
Choctaw RD - Heavener, OK
Clinch RD - Wise, VA
Cohutta RD - Chatsworth, GA
Cold Springs RD - Booneville, AR
Conecuh RD - Andalusia, AL
Croatan RD - New Bern, NC

Deerfield RD - Staunton, VA
Delta National Forest - Rolling Fork, MS
Delta RD - Rolling Fork, MS
Desoto National Forest, Chickasawhay RD - Laurel, MS
Desoto National Forest, Black Creek RD - Wiggins, MS
Desoto National Forest, Biloxi RD - McHenry, MS
Dry River RD - Bridgewater, VA

El Yunque RD - Palmer, PR

US FOREST SERVICE OFFICES - continued

Enoree RD - Whitmire, SC
Evangeling RD - Alexandria, LA

Fourche RD - Danville, AR
French Broad RD - Hot Springs, NC

Gleenwood RD - Natural Bridge Station, VA
Grandfather RD - Marion, NC

Highlands RD - Highlands, NC
Hiwassee RD - Etowah, TN
Holly Springs National Forest, Holly Springs RD - Holly Springs, MS
Holly Springs RD - Holly Springs, MS
Homochitto National Forest, Bude RD - Meadville, MS
Homochitto RD - Gloster, MS
Homochitto National Forest, Homochitto RD - Gloster, MS

James River RD - Covington, VA
Jessieville RD - Jessieville, AR

Kiamichi RD - Talihina, OK
Kisatchie RD - Natchitoches, LA

Lake George RD - Silver Springs, FL
Lee RD - Edinburg, VA
London RD - London, KY
Long Cane RD - Edgefield, SC

Magazine RD - Paris, AR
Mena RD - Mena, AR
Morehead RD - Morehead, KY
Mt. Rogers NRA - Marion, VA

National Forest in Mississippi, SO - Jackson, MS
Neches RD - Crockett, TX
New Castle RD - New Castle, VA
Nolichucky RD - Greeneville, TN

O&Tig Pao File - Washington, DC

US FOREST SERVICE OFFICES - continued

Oakmulgee RD - Centreville, AL
Ocoee RD - Benton, TN
Oconee RD - Monticello, GA
Oden RD - Oden, AR
Osceola RD - Olustee, FL

Pedlar RD - Buena Vista, VA
Pisgah RD - Pisgah Forest, NC
Pleasant Hill RD - Clarksville, AR
Poteau RD - Waldron, AR

Raven RD - New Waverly, TX
Redbird RD - Big Creek, KY

San Jacinto RD - Cleveland, TX
Seminole RD - Umatilla, FL
Shoal Creek RD - Heflin, AL
Somerset RD - Somerset, KY
St. Francis RD - Marianna, AR
Stanton RD - Stanton, KY
Stearns RD - Whitley City KY
Strong RD - Raleigh, MS
Sylamore RD - Mountain View, AR

Talladega RD - Talladega, AL
Tallulah RD - Clayton, GA
Tellico RD - Tellico Plains, TN
Tenaha RD - San Augusting, TX
Tiak RD - Idabel, OK
Toccoa RD - Blue Ridge, GA
Toecane RD - Burnsville, NC
Tombigbee National Forest, Tombigbee RD - Ackerman, MS
Tombigee RD - Ackerman, MS
Trinity RD - Apple Springs, TX
Tuskegee RD - Tuskegee, AL
Tusquitee RD - Murphy, NC
Tyger RD - Union, SC

Unaka RD - Erwin, TN
Uwharrie RD - Troy, NC

Vernon RD - Leesville, LA

US FOREST SERVICE OFFICES - continued

WW Ashe Nursery - Brooklyn, MS
W.W. Ashe Nursery - Brooklyn, MS
Wakulla RD - Crawfordville, FL
Wambaw RD - McClellanville, SC
Warm Springs RD - Hot Springs, VA
Watauga RD - Elizabethan, TN
Wayah RD - Franklin, NC
Winn RD - Winnfield, LA
Winona RD - Perryville, AR
Witherbee RD - Moncks Corner, SC
Womble RD - Mt. Ida, AR
Wythe RD - Wytheville, VA

Yellow Pine RD - Hemphill, TX

CHAPTER 6

GLOSSARY

<u>ABANDONED CLUSTER</u> - A cluster which has not been used by RCW for an extended period of time. A 5 - 10 year period of inactivity is necessary to declare a cluster abandoned. Abandoned clusters should not be managed as clusters unless identified as a replacement or recruitment stand.

<u>ACTIVE CLUSTER</u> - A cluster that is occupied by RCW in a given survey year. A cluster is determined to be active when there are nesting or roosting red-cockaded woodpeckers present, or when one or more cavity trees exhibit fresh pitch wells and resin flow, reddish under-bark appearance and/or fresh chipping is present at the cavity entrance.

<u>ALLOWABLE HARVEST</u> - Expressed as a percent of the forest area (in this FEIS, an HMA or other RCW management area), of a particular forest type, that could be harvested during the period or decade.

<u>ALLOWABLE SALE QUANTITY</u> - The quantity of timber that may be sold from the area of suitable land covered by the forest plan for a time period specified by the plan. This quantity is usually expressed on an annual basis as the "average annual sale quantity."

<u>ANNUAL (plant)</u> - A plant species with a life span of one year or growing season.

<u>ANTHOPHILOUS</u> - Any insect that uses flowers during its life cycle.

<u>ARTIFICIAL CAVITY</u> - Any RCW cavity that is man-made. Artificial cavities may be established by drilling a new cavity or by installing a cavity insert within an appropriate tree.

<u>AUGMENTATION</u> - see Translocation

<u>BALANCED UNEVEN-AGED STAND</u> - This theoretical all-aged stand would have trees of each age and or size class from seedlings to mature trees of near maximum tree size (rotation age), with each size (age) class occupying an approximately equal area.

<u>BASAL AREA (BA)</u> - The cross-sectional area of a stand of trees measured at breast height (4 feet 6 inches above ground). The area is expressed in square feet per acre and is a measure of stocking density.

<u>BIENNIAL (plant)</u> - A plant species that completes its life cycle from seed germination to seed production in two years or growing seasons.

<u>BIOLOGICAL DIVERSITY</u> - There are many definitions for biological diversity. Some of the common elements in the definitions include species, genes, communities, and biological processes. The disclosure of effects on biological diversity in this EIS concentrates primarily on species diversity, habitat diversity, and the abundance and distribution of individuals and species.

<u>CATEGORY 1</u> - Taxa for which there is substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species.

CATEGORY 2 - Taxa for which information now indicates that proposing to list as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threat is not currently available to support proposed rules. Further research and study will be necessary of any taxa in this catagory.

CAVITY TREE - A tree that contains a red-cockaded woodpecker cavity or start hole. It may be artificial or RCW excavated.

CLAN - see Group

CLEARCUTTING METHOD - An even-aged regeneration method in which new trees become established in full sunlight after removal of all or most of the trees in a stand. Regeneration can originate naturally or artificially.

CLUSTER - also COLONY or COLONY SITE - an aggregate of cavity trees plus a 200-foot buffer around this cluster of trees. In most cases this cluster of trees can be encompassed by a circle 1500 feet in diameter. A cluster must include at least one cavity tree. A cluster is identifed as a stand of 10 acres or more.

CORRIDOR OR HABITAT LINKAGE - Continuous stands of pine or pine-hardwood at least 30 years of age that form a corridor or habitat linkages to maintain continuity of RCW habitat between clusters. The actual stands serving as a habitat linkage can vary through time. These areas link individual clusters up to three miles apart, where practicable.

Additionally, groups of 5 or more linked clusters should be linked if the nearest clusters are less than 20 miles apart. All distances should be measured from the cluster centers. When corridors between cluster sites or groups of five or more clusters cannot be maintained because of private land, water bodies, etc., serve as barriers to RCW movement, a reasonable effort should be made to establish the corridors along tracts of National Forest, other public lands with a suitable easement that is the most direct and least interrupted linkage.

CUMULATIVE EFFECTS - is the effect on the environment resulting from the proposed action, other past, present, and reasonably forseeable future actions regardless of who is responsibile for these other actions. Cumulative effects can result from individually minor, but collectively significant actions taking place over a period of time.

DAMAGED STAND - To qualify as either damaged or sparse, a stand must have less than the following basal areas in trees classed as growers:

Tree Size	BA
Poletimber	30
Sawtimber Height	
36-65	30
66-95	40
96+	50

Growers are the trees tallied as leave trees after removing noncommercial species, rotten culls, overtopped, salvage and sanitation, and thinners.

DBH (diameter at breast height) - The diameter of a standing tree measured 4 ft. 6 inches from the ground.

DECIDUOUS - Pertaining to any plant organ or group of organs that is shed naturally; perennial plants that lose their leaves part of the year, i.e., hardwood trees such as oak, hickory, maple.

DEMOGRAPHIC ISOLATION - RCW clusters or subpopulations that are separated by more than five miles or more of currently suitable RCW habitat or three miles or more of currently or permanently unsuitable habitat are considered to be demographically isolated.

DESTROYED CLUSTER - A RCW cluster in which the cavities have been made unusable by enlargement or rot, or the cavity trees have died. A cluster will not be declared destroyed until a followup survey during a subsequent nesting season is completed to confirm the lack of new cavity trees within 1,500 feet of the cluster. Artificial cavities may be utilized to rebuild the cluster if birds are present. A destroyed cluster is not otherwise managed as a cluster, unless identified as a replacement or recruitment stand.

DIRECT EFFECTS - Effects that occur at the same time and place as the triggering action.

DUFF LAYER - The lower portion of the organic material layer that covers mineral soil, consisting of decomposed litter. See "litter layer."

ECOSYSTEM - All interacting populations of plants, animals, and microorganisms occupying an area, plus their physical environment.

ECOTONE - The place where plant communities meet or overlap and where successional stages of vegetative conditions within plant communities come together.

ESSENTIAL WILDERNESS COLONY - Those RCW clusters in wildernesses identified in the Southern Pine Beetle Environmental Impact Statement and US Department of Interior, Fish and Wildlife Service Biological Opinion dated Dec. 12, 1986 as essential for the recovery of the species.

EVEN-AGED STAND - A stand in which all the trees are approximately the same age for almost all the life of the stand. The difference in age between the youngest and oldest trees is less than 20 percent of the rotation. Some even-aged stands may have a few individuals or clumps of older trees or small gaps filled with younger pine trees, randomly distributed, which do not significantly affect the even-aged stand structure.

EXTIRPATION - (local extinction) Removal of a species from a geographical portion of its original range; the species still exists, but its range is now much smaller. An example would be the mountain lion, which once occurred throughout the United States, but now, due to human pressure has been extirpated except in areas of the Western United States.

FORAGING HABITAT - Pine and pine-hardwood forest stands 30 years of age and older within 1/2 mile of a red-cockaded woodpecker cluster with at least 6,350 pine stems equal to or greater than 10 inches in diameter and 8,490 square feet of pine basal area.

FORMAL CONSULTATION - A process between the United States Fish and Wildlife Service or National Marine Fisheries Service (FWS and NMFS) and another federal agency commencing with the action agency's written request for consultation under section 7(a) (2) of the Endangered Species Act of the effects of a proposed action on a listed species or critical habitat and concluding with the FWS's or NMFS's issuance of a biological opinion under section 7 (b) (3) of the ESA. Formal consultation is required unless the action agency determines, with the written concurrence of the Director of the FWS or NMFS that the proposed action is not likely to adversely affect any listed species or critical habitat.

FUELS - Any material that will carry and sustain a forest fire, primarily natural materials, both live and dead.

FRAGMENTATION - This term is used in reference to suitable habitat of red-cockaded woodpecker. It is the scattering or isolating of habitat required by the RCW.

GENETIC ISOLATION - RCW populations/subpopulations separated by 18 miles or more of currently suitable or 5 miles or more of currently unsuitable habitat are considered genetically isolated. There is no interchange of genetic material between populations.

GROUP -(clan) - Normally a breeding pair of red-cockaded woodpeckers, plus helpers, living as a family group. Group size can vary from a mated pair to as many as nine individuals, but averages about three birds. Occasionally, group size may be reduced to a single individual (usually a male). A single bird group is usually a temporary phenomenon, with either successful mating or cluster abandonment occurring within a short period of time.

GROUP SELECTION METHOD - A regeneration method resulting in an uneven-aged forest stand in which trees are removed in small groups to create openings throughout the stand. Maximum opening size is generally restricted to an area no more than two times the height of the surrounding stand, but may be as large as two acres.

HABITAT - The physical and biological environment of a plant or animal where all essentials for its development and existence are present.

HABITAT MANAGEMENT AREA-(HMA) - It is an area dedicated to RCW management to encompass sufficient habitat for the desired population objective and future demographic configuration of a red-cockaded woodpecker population.

HANDBOOK - The Forest Service's Wildlife Habitat Management Handbook, FSH 2609.23R, RCW chapter.

HERBACEOUS - Vegetation that does not develop woody tissue above the ground. These include grasses and most perennial ground-cover flowers.

HISTORIC CLUSTER - A cluster in which the cavity trees no longer exist. This classification includes destroyed clusters, once the cavity trees are gone. These clusters are known only from historic records. If not suitable as or identified as a replacement or recruitment stand, they are not managed as a cluster.

INACTIVE CLUSTER - A cluster is determined to be inactive when there are no red-cockaded woodpeckers present and when none of the cavity trees exhibit on active resin wells. Active resin wells are noted by recent pecking and clear, fresh resin flowing from the well, reddish under-bark appearance or fresh chipping of cavity entrance or plate. Inactive status is warrented and determined when a specific cluster is unoccupied in a given year. Clusters classified as inactive should have cavities suitable for use by RCW.

INCIDENTAL TAKE - The taking of an endangered or threatened species which the USFWS formally recognizes in a biological opinion as incidental to, and not the purpose of, carrying out an otherwise lawful activity conducted by a Federal Agency or applicant. Taking includes harm, harass, pursue, hunt, kill, trap, capture, or collect, or attempt to engage in any such conduct. A biological opinion may provide for incidental take under certain terms and conditions may be permitted in a biological opinion upon the finding that the action agency will not thereby violote the ESA's prohibition on jeopardizing a species.

INDIRECT EFFECTS - Those effects which occur at a later time or at some distance from the triggering action, but are reasonably foreseeable.

INFORMAL CONSULTATION - All discussions, correspondence, etc., between the FWS or NMFS and the federal action agency designated to assist the action agency in determining whether formal consultation is required. If during informal consultation it is determined by the federal action agency, with the written concurrence of the FWS or NMFS, that the action is not likely to adversely affect listed species or critical habitat, the consultation process is terminated and no further action is necessary.

INTERIM OR INTERIM S&Gs - An abbreviation for Interim Standards and Guidelines for the Protection and Management of RCW Habitat Within 3/4 Mile of Colony Sites. This is the RCW management currently being implemented within 3/4 mile of active and inactive RCW clusters (colony sites) on National Forest lands. It will remain in effect until the the revised regional RCW management direction is incorporated into individual forest plans through amendment or revision.

INTERSTITIAL SPACES - Area between nonoverlapping 3/4-mile radius circles around active and inactive RCW clusters.

INVALID CLUSTER- A stand misidentified as a red-cockaded woodpecker cluster. It has been found that in older survey information, trees with pileated woodpecker feeding holes or sapsucker feeding holes were occasionally misidentified as RCW cavity trees. If such a misidentification is confirmed by a biologist, the cluster is deleted from the cluster inventory and not managed as a cluster. A cluster will not be declared invalid until a followup survey is completed to confirm the lack of new cavity trees within 1,000 feet of the cluster.

IRREGULAR SHELTERWOOD METHOD - A variant of the shelterwood method in which the overwood is retained for a significant portion of the rotation. The irregular shelterwood differs in that the final removal cut may occur later in the rotation or not at all. This results in a stand that contains two age classes for most of the rotation. "Irregular" refers mainly to the variations in tree heights within the new stand.

ISOLATED CLUSTER - See Demographic Isolation.

ISOLATED SUB-POPULATION - See Demographic Isolation

JEOPARDY OPINION - A biological opinion rendered by the USFWS that states the proposed action is likely to jeopardize the continued existence of a listed species or result in destruction or adverse modification of its critical habitat.

LITTER LAYER - The upper portion of the organic layer covering the soil. The litter layer consists of unaltered dead remains of plants, insects and animals, whose original form is still visible.

MIDSTORY - A middle canopy layer of smaller trees that occur under an overstory of trees. Midstory trees are usually of a different species than the large trees and can grow in almost total shade. Some trees in this category include dogwood, red maple, sourwood, holly, some hickories, oaks and gums. Usually these trees never develop into large, dominant forest trees.

MANAGEMENT INTENSITY LEVEL (MIL) - The MIL concept varies the level of management and protection to the survival needs of different RCW populations depending on their size and whether they are increasing or decreasing. The concept is similar to the way hospitals treat their patients based on the severity of their illness or injury: emergency, intensive care, general care, and outpatient services. It is based on research which indicates small RCW populations composed of widely distributed groups need more protection and different management than larger populations made up of more closely spaced groups.

MITIGATION MEASURES - An action taken during a project's implementation to lessen adverse impacts or enhance beneficial effects. These measures may take place before, during, or after implementation of the project.

NATURAL REGENERATION - The renewal of trees by natural means, self-sown seed or vegetative means such as sprouts. The term also refers to the young trees themselves.

NESTING HABITAT - Stands of older aged pine trees or younger stands containing scattered older tees. The age a tree must reach to be considered potential nesting habitat varies by pine species. Generally loblolly pines become suitable around the age of 70 years. Longleaf pine normally does not become suitable before 90-95 years of age.

NEST TREE - See "Cavity Tree".

NONJEOPARDY OPINION - A biological opinion rendered by the USFWS that states the proposed action is not likely to jeopardize the continued existence of a listed species or result in destruction or adverse modification of its critical habitat.

OFF-SITE TREE SPECIES - In this document the term "off site" refers to any pine species growing on a site which was historically occupied by another species, regardless of how well or how poorly the off site species is growing.

OVERSTORY - That portion of the trees in a forest of more than one story, forming the upper or uppermost canopy level.

PERENNIAL - A plant species that has a life span of more than two years.

PETS SPECIES - An abbreviation for proposed, endangered, threatened, and sensitive species.
P = species proposed for Federal listing as threatened or endangered.
E = Federally listed endangered species
T = Federally listed threatened species
S = species included on the Regional Forester's sensitive species list.

PINE RESTORATION - The restoration of pine species on sites which they occupied historically. Longleaf will probably be the pine species restored most frequently, but other species, shortleaf, loblolly, etc., may also be restored. Pine species being restored to appropriate sites usually live longer and are less susceptible to disease and insect attack. They are usually the species preferred by the RCW for that specific area.

PLANT COMMUNITIES - An association of plants of various species found growing together in different locations with similar site characteristics.

POPULATION OR GENETIC POPULATION - All RCW within an area which are separated by 18 miles or less of currently suitable habitat or 5 miles or less of currently unsuitable habitat.

POTENTIAL CAVITY TREE - A pine tree which currently exhibits (or is likely to exhibit in the future) characteristics of high quality red-cockaded woodpecker cavity trees: presence of red-heart fungus at average cavity height, 14 inches DBH or larger, high ratios of heartwood to sapwood, clear and straight boles and large, flat topped crowns with large limbs.

PRECOMMERCIAL THINNINGS - Thinnings made in stands so young that none of the trees removed have commercial value or use. These thinnings are made as investments in the future growth of the stand.

PRESCRIBED BURNING - The controlled application of fire to wildland fuels in either a natural or modified state, under specified environmental conditions, which allows the fire to be confined to a predetermined area and at the same time produce the intensity required to attain planned resource management objectives.

RECOVERY POPULATION - The RCW Recovery Plan identifies 15 populations, by physiographic province, which must have long-term viable populations in order for the species to be declared recovered. These populations are distributed over the historic range of the RCW. Twelve of the 15 populations are totally or partially dependent on National Forest System lands.

RECRUITMENT STAND - Stands of pine trees 10 acres or larger containing older trees (usually the oldest available stands) which are designated to provide potential nesting habitat for RCW population expansion. They are located within 1/4 to 3/4 mile of an active cluster or another recruitment stand and must have adequate foraging habitat connected to them. They may or may not contain artificial cavities. They **are not** managed for multiple use and will remain in place as long as they contain trees suitable as potential cavity trees.

REGENERATION - The replacing of old trees, either naturally or artificially, with new tree growth. Also refers to the new tree growth that develops.

<u>**RELICT TREE, (Relicts)**</u> - A pine tree which is left over from the original forests that were harvested during the period of 1890 - 1930. They are usually more than 100 years old and exhibit characteristics of high quality red-cockaded woodpecker cavity trees: presence of red-heart fungus (rot or decay) at average cavity height, 14 inches DBH or larger, high ratios of heartwood to sapwood, and large, flat-topped crowns with large limbs. Most of the red-cockaded woodpecker cavity trees in use are relicts.

<u>**REPLACEMENT STAND**</u> - Ten acre or larger stands of pine trees located within 1/2 mile of and preferrably adjacent to all active RCW clusters designated to serve as replacement habitat for existing clusters when the trees die or become unsuitable for RCW. Ideally they should be 20-30 years younger than the nearby cavity trees. Like recruitment stands, they are not managed for multiple use and are retained as long as potential cavity trees exist. Since the replacement stand is considered a part of an active cluster, additional foraging habitat is not required.

<u>**REPRODUCING POPULATION**</u> - The average number of RCW groups successfully fledging young in a given population. A recovered population needs 250 pairs of RCWs actively breeding and fledging young annually.

<u>**ROTATION**</u> - The planned number of years between the regeneration (establishment) and final cutting of trees at a specified stage of maturity (biological or economic).

<u>**SEED-TREE METHOD**</u> - An even-aged regeneration method in which new trees become established from seed produced by trees retained from the previous stand. Seed trees may be removed or retained.

<u>**SHELTERWOOD METHOD**</u> - An even-aged regeneration method in which new trees become established before complete removal of the previous stand. Residual trees are removed within 20 percent of the rotation.

<u>**SILVICS**</u> - The study of the biological principles underlying the life history, growth, and development of single trees and the forest as a biological unit with particular reference to environmental factors.

<u>**SILVICULTURE**</u> - Generally, is the science and art of regenerating and tending a forest to meet specific objectives and is based on a knowledge of silvics.

<u>**SILVICULTURAL SYSTEM**</u> - A program for the treatment of a stand during a whole rotation. Although the silvicultural system includes both the method of regeneration and any tending operations, it is normally given the name of the regeneration method used.

<u>**SINGLE-TREE SELECTION METHOD**</u> - A regeneration method to create or maintain an uneven-aged forest stand by periodically removing selected trees from all diameter classes throughout the stand.

<u>**SITE PREPARATION**</u> - The removal of competition and conditioning of the soil to create environmental conditions (microsites) that enhance the survival and growth of seedlings or to enhance the germination of seed.

<u>**SNAG**</u> - A standing dead tree.

SPARSE STAND - To qualify as either damaged or sparse, a stand must have less than the following basal areas in trees classed as growers:

Tree Size	BA
Poletimber	30
Sawtimber Height	
36-65	30
66-95	40
96+	50

Growers are the trees tallied as leave trees after removing noncommercial species, rotten culls, overtopped, salvage and sanitation, and thinners.

STAND - A contiguous group of trees sufficiently uniform in species composition, arrangement of age classes, and condition to be a distinguishable unit. The internal structure of stands varies mainly due to the degree that different species and age classes are intermingled.

STOCHASTIC - Something that is random or involves chance, such as the likelihood of a natural disturbance occurring.

SUB-HMA - That portion of an HMA where the existing RCW population is located. Its acreage associated with it must be large enough to support 50 groups.

SUBPOPULATION - An aggregate of RCW clusters which are separated from other clusters by 5 miles or more of currently suitable habitat or 3 miles or more of currently or permanently unsuitable habitat. RCW groups within the aggregate of clusters must be close enough to each other to provide significant interchange of RCW between the individual groups to ensure at least short-term viability.

SUCCESSION - The progressive, staged development of vegetation (including trees and other plants) toward their highest role or position in their ecology: their climax. The replacement of one forest growth stage by another stage.

SUITABLE HABITAT - The most appropriate habitat for a given species of plant or animal, acccording to their needs for a healthy existence.

SUITABLE RCW HABITAT - There are two classifications of suitable RCW habitat: Currently suitable habitat is pine (except white and sand pine) and pine-hardwood stands which currently meet the criteria to be classified as foraging habitat, 30 years of age or older and 10 inches diameter or larger. Potentially suitable habitat is all pine and pine-hardwood stands regardless of tree age or size. The following forest types could be considered suitable RCW habitat:

Pine Types	Pine-Hardwood Types
Longleaf pine	Shortleaf pine-oak
Slash pine	Loblolly pine-hardwood
Loblolly pine	Slash pine-hardwood
Shortleaf pine	Pitch pine-oak
Virginia pine	Virginia pine-oak
Pond pine	Pond pine-hardwood
Pitch pine	

SUPPORT POPULATION - A RCW population that is not a recovery population.

THINNING - Intermediate cuttings aimed primarily at controlling growth of timber stands by adjusting stand density.

TRANSLOCATION -(**AUGMENTATION**) - The trapping and moving of RCW from one location to another. The most common type of translocation is AUGMENTATION, the movement of an appropriate-sex juvenile RCW to a cluster currently occupied by a single bird. A successful augmentation, i.e., the birds pair and mate, results in an additional breeding pair within the population and may result in population growth as a result of their offspring.

TWO-AGED STAND - A stand that contains two age classes for most of the rotation. The differences in age between the oldest and youngest trees is greater than 20 percent of the rotation.

UNEVEN-AGED STAND - A stand with trees of three or more distinct age classes, either intimately mixed or in small groups.

UNSUITABLE RCW HABITAT - There are two classifications of unsuitable habitat: Permanently unsuitable habitat is nonforest land such as agricultural fields, water bodies, or extensive areas of hardwood forest such as hardwood river bottoms. Currently unsuitable habitat (also called potentially suitable habitat) are pine and pine-hardwood stands which currently do not meet the criteria to be classified as foraging habitat, 25 or 30 years of age or older and 10 inches diameter or larger.

3/4 MILE ZONE - The habitat management zone, within 3/4-mile radius, designated around all active and inactive clusters in RCW populations being managed under Interim. The circle contains approximately 1117 acres. It is divided into two management zones: Suitable habitat within 1/4 mile of the cluster is critical to sustaining the cluster and receives greater protection. The area between 1/4 and 3/4 mile from the cluster allows a greater range of management activities, but emphasis is on providing potential nesting habitat, foraging and avoiding fragmentation of the habitat.

Because RCW management objectives are different in each zone, each is identified separately and specific habitat management direction and mitigation measures are provided for within this document.

Frequently used acronyms:

BA	-	Basal Area
DBH	-	Diameter at Breast Height
EA	-	Environmental Assessment
EIS	-	Environmental Impact Statement
ESA	-	Endangered Species Act
HMA	-	Habitat Management Area
MIL	-	Management Intensity Level
MOU	-	Memorandum of Understanding
NEPA	-	National Environmental Policy Act
NFMA	-	National Forest Management Act
PETS	-	Proposed, Endangered, Threatened or Sensitive Species
RCW	-	Red-cockaded Woodpecker
ROD	-	Record of Decision
S&G		Standards and Guidelines
SPB	-	Southern Pine Beetle
TES	-	Threatened, Endangered or Sensitive Species
USDA	-	United States Department of Agriculture
USDI	-	United States Department of Interior

CHAPTER 7

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APPENDIX A

DELINEATION OF RCW HABITAT MANAGEMENT AREAS AND SETTING POPULATION OBJECTIVES

A. INTRODUCTION

Since the Forest Service first became involved in management of the RCW in 1975, emphasis has been placed on the protection and management of the cluster and some amount of foraging habitat contiguous to it. In large, well dispersed populations (Francis Marion, Apalachicola, Vernon), this strategy seems to have been successful. Unfortunately, in the smaller populations with more widely scattered clusters, most populations continued to decline. The importance of spatial arrangement (demography) of groups within a population to the viability of that population has only recently come to light through research conducted at North Carolina State University (Walters 1990, Walters et al. 1988b, Walters, Doerr and Lapp personal communication).

The following criteria will be used to identify recent historic RCW populations, isolated subpopulations, delineate Habitat Management Areas (HMA), and establish population objectives. Two terms, populations and isolated subpopulations are used frequently. Following are the definitions of these terms as used in this appendix:

Population: May also be used interchangeably with the term genetic population. A population is an aggregate of groups which are close enough together to provide adequate genetic interchange through dispersal of juvenile RCW to ensure long-term genetic viability. With RCW, all groups separated by more than 18 miles of currently suitable foraging habitat or 5 miles or more of currently unsuitable foraging habitat should be considered separate populations. These distances should be measured along the route of suitable foraging habitat linkage.

Isolated subpopulation: An isolated subpopulation is an aggregate of groups close enough to each other to provide significant interchange between the individual groups, ensuring at least short-term viability. The subpopulations are also close enough to other subpopulations to provide adequate interchange through dispersal of juvenile and adult RCW to offset mortality or other losses within adjacent groups. If an aggregate of groups is separated from other groups by 5 miles or more of currently suitable foraging habitat or 3 miles or more of currently unsuitable foraging habitat, they would be considered a demographically isolated subpopulation. An isolated subpopulation could contain only one group.

B. GENERAL

All Forest Service administrated lands with RCW clusters now, or which had them historically, or are within 18 miles of existing clusters on non-Forest Service land, are to be analyzed to determine the long-range capability to support RCW. The amount of pine and pine/hardwood acres allocated to RCW management should be based on the procedures and criteria outlined in this appendix. The objective is to maintain all existing RCW populations on National Forest System lands and evaluate the possibility of reintroducing RCW on those Forest Service units where they occurred historically, but no longer exist. The 12 Forest Service populations needed for recovery, as identified in the Fish and Wildlife Service's RCW Recovery Plan, will be managed for a number of actively reproducing groups large enough to ensure long-term genetic viability, if adequate habitat is available.

Support populations, those not identified as recovery populations, will be managed for at least enough groups to ensure short-term viability (100-300 years). The HMAs delineated for support populations should be managed for as large a population as the acreage will allow. Such management should minimize the potential impacts of catastrophic events.

Population objectives for recovery populations should be based on reproducing population size, i.e., the number of groups fledging young annually in a given population. Population objectives in support populations will be based on total number of groups. Reproducing population size is also critical in support populations. A minimum of 50 percent of the total number of groups should be fledgling young annually. Management efforts should be used to increase the reproducing population as high as possible. The area devoted to RCW management should be large enough to ensure that the population objective can be sustained.

An even distribution of groups over the HMA is just as important as the number of groups in determining population objective attainment. Groups located within wildernesses should not be included in HMA population objectives nor should wilderness acres be included within the HMA unless the specific wilderness management plan allows adequate RCW management flexibility to sustain them. In situations where wilderness groups are identified as essential, the Forest is encouraged to develop and implement an appropriate wilderness management plan to sustain the groups, especially in wilderness with a significant longleaf pine component.

The following summarizes the steps in delineating HMAs and determining RCW population objectives for those HMAs. All distributions of active and inactive clusters will be based on 1986 data. This represents the first year an effort was made to collect reliable RCW data on all Forest Service Units. In situations where populations may have increased since 1986, use the higher population figure.

Step 1 - Based on 1986 historic cluster distribution, delineate RCW populations. Output is a map showing the configuration of all populations on or adjacent to Forest Service lands. See the section on RCW Population Delineation for a detailed discussion.

Step 2 - Based on 1986 group distribution, identify isolated subpopulations. Output is a map showing isolated subpopulations on or adjacent to Forest Service lands. Include both active and inactive clusters. See section on RCW Subpopulation Delineation for a detailed discussion.

Step 3 - Based on isolated subpopulations and cluster distribution (active and inactive) delineate the RCW HMAs. Output is a map showing the HMA boundaries and a summary of suitable RCW habitat (acres) in each HMA. See section on RCW HMA Delineation for a detailed discussion.

Step 4 - Based on the acres of suitable RCW habitat in each HMA and the physiographic province in which each HMA is located, determine the population objective for each HMA. See section on "Setting RCW Population Objectives" for a detailed discussion.

C. RCW POPULATION DELINEATION

1. Background

The first step in setting a RCW population objective is to delineate the RCW population boundaries by identifying suitable habitat and active and inactive clusters. The usual criterion used to measure sufficient transfer of genetic material between areas to maintain genetic identity is one successful dispersal (successful nesting) in each direction per generation (Schonewald-Cox et al. 1983). The RCW has a generation time of about four years, therefore, it would require at least five successful dispersals per decade between isolated subpopulations to effectively call these units the same genetic population. Clusters on all land ownerships should be considered in population delineations.

2. Procedure

Population delineation is simply drawing a line around all the clusters (active and inactive) determined to be part of one genetic population. First, map all known clusters (1986) on the District (or Forest) and any known within 18 miles of the District (or Forest). Use existing and readily available information, Forest Service RCW surveys, state natural heritage program data, Fish and Wildlife Service, adjacent landowners, etc.

Active clusters separated by greater than 18 miles of nonfragmented currently suitable RCW foraging habitat, or greater than 5 miles of currently nonforaging habitat, should be considered part of separate populations. If active clusters do not exist, use the distance between nearest inactive clusters to identify separate populations. Use total cluster distribution to identify each RCW population. Every cluster must be in a population. Do not use the nearest active neighbor distance when identifying separate populations without considering core population locations in relation to edge clusters **(Figure 1)**, or strings of clusters in which each individual link may be at the outer extreme of dispersal range **(Figures 2 and 3)**.

The following is a discussion of each of these figures:

Figure 1 - If the distance between two groups of peripheral clusters, each demographically isolated from their core populations, is less than 18 miles, but the distances between the core population areas is greater than 18 miles, they should not be called one population.

Figure 2 - A series of demographically isolated single or small groups of clusters, each less than 18 miles from each other, but with over 18 miles between opposite ends of the series, should not be called one population. Assuming a homogenous habitat condition in Figure 2, the population delineation is somewhat subjective. Population A could have included one or more additional clusters to the south, or Population B could have included one or more additional clusters to the north. The key point in Figure 2 is that there should be two populations, even though the actual distance between active clusters is less than 18 miles. The specific separation should be based on site-specific habitat conditions, etc.

Figure 3 - A series of clusters that are not demographically isolated (none of the groups are more than 5 miles apart) should be called one population.

Prepare a map showing all active and inactive clusters, known in 1986, on and within 18 miles of the Forest Service administrative unit. Delineate the boundary of the population(s) on Forest Service System lands.

The inclusion of private land clusters in this analysis in no way implies intent by the Forest Service to acquire or apply its management to these lands. They are included only to better describe the overall historic range of the RCW in that general area.

Figure A-1
Population Delineation with Demographically Isolated Peripheral Clusters

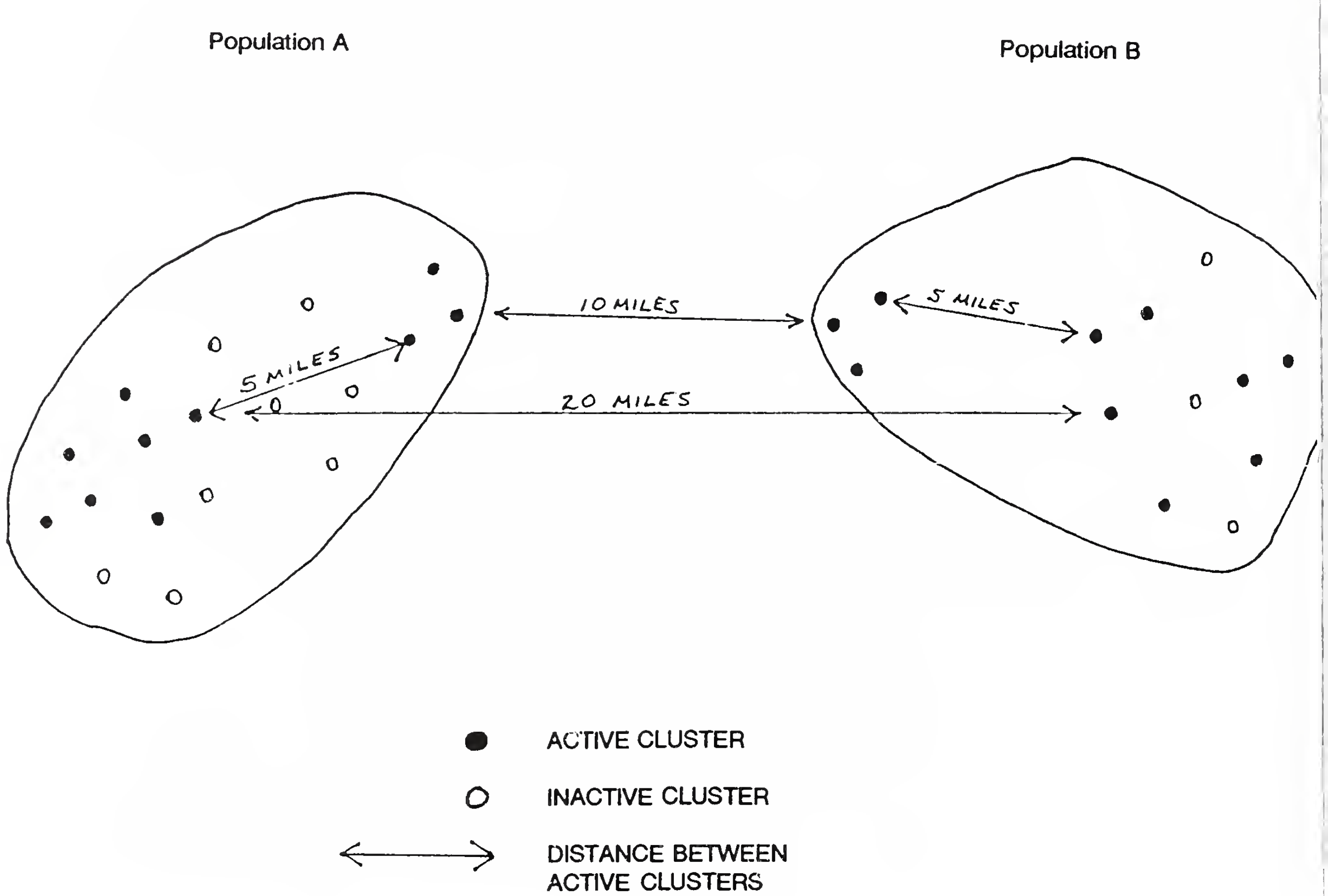


Figure A-2
Population Delineation with Demographically Isolated String of Clusters

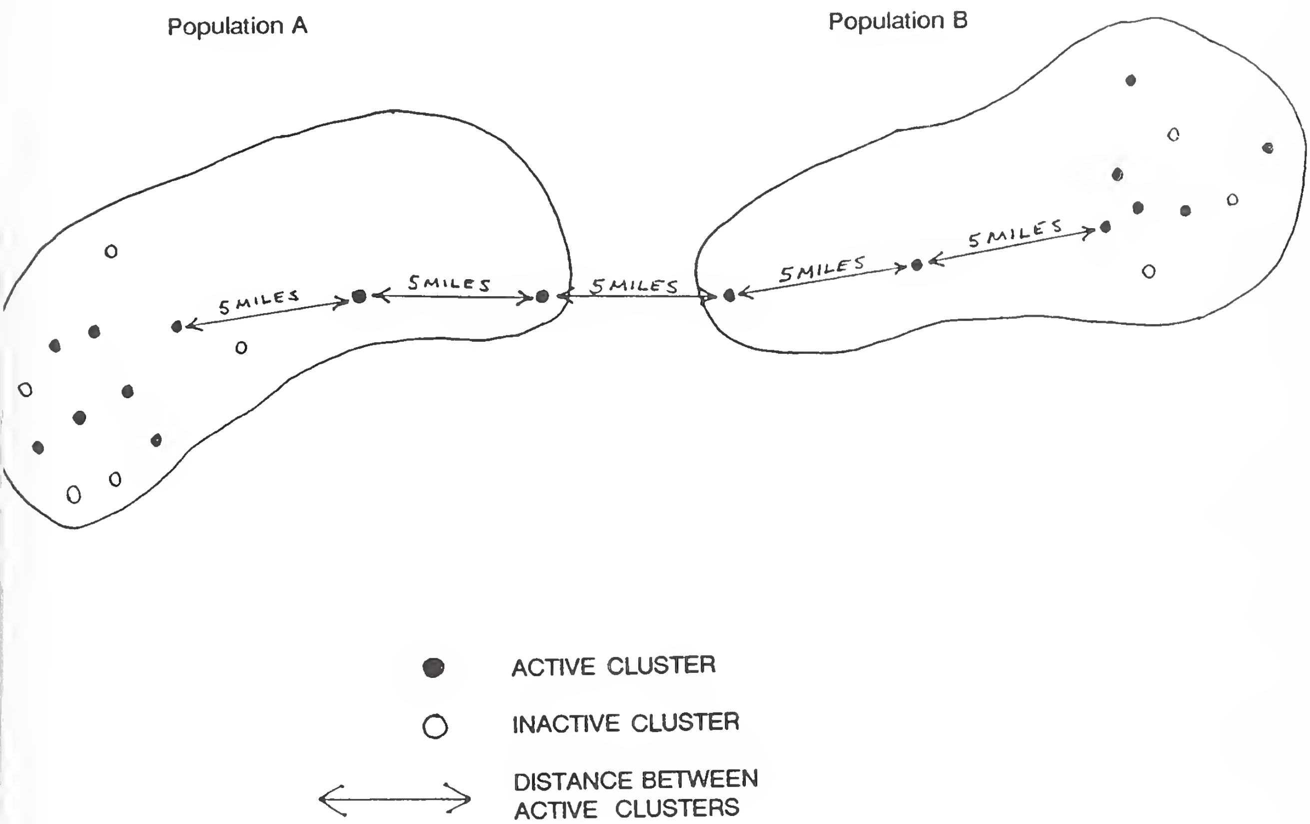
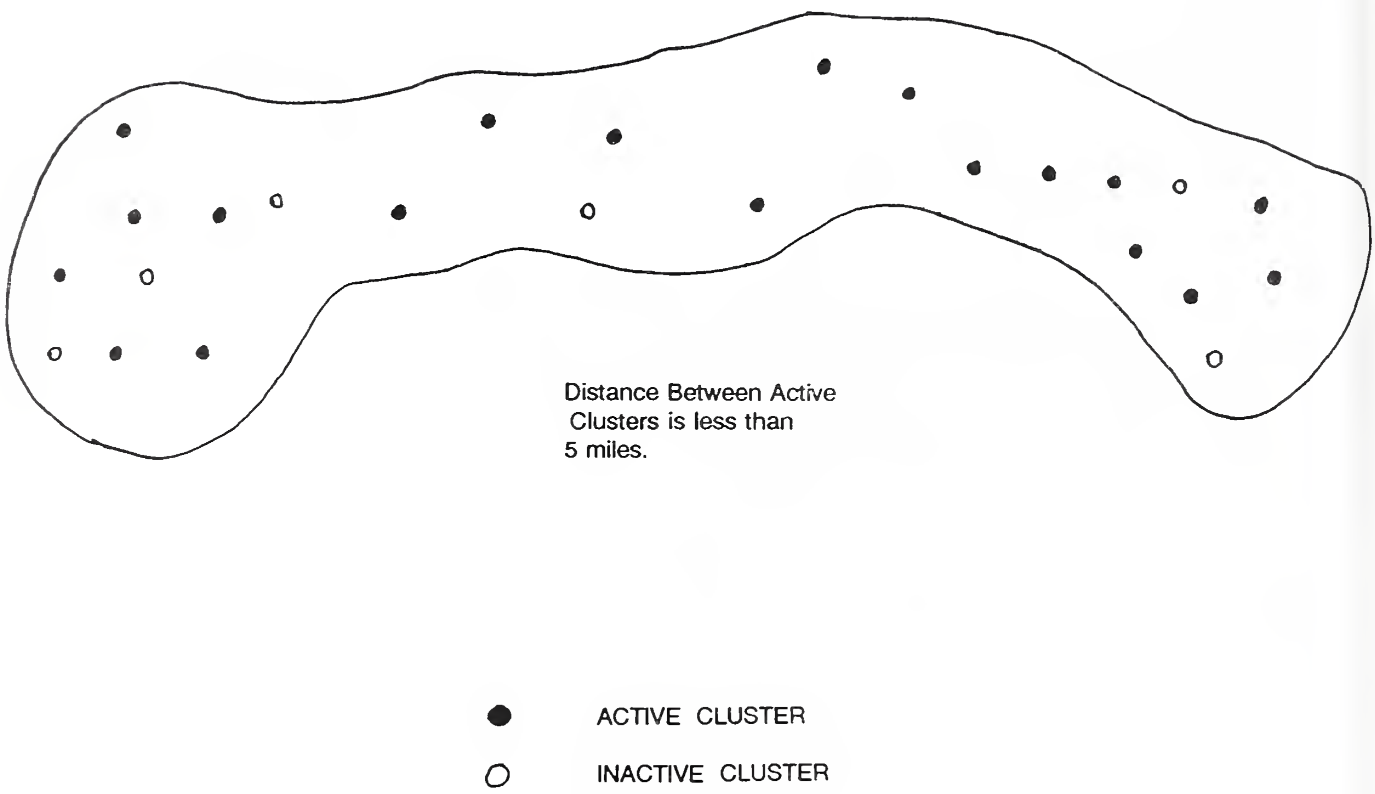


Figure A-3
Population Delineation with Demographically Linked String of Clusters



D. RCW DEMOGRAPHIC SUBPOPULATION DELINEATION

1. Background

The second step in delineating RCW HMAs and setting population objectives is to delineate isolated subpopulations within the population. The basic unit of management to ensure short-term viability is the isolated subpopulation. The ability of the groups to offset mortality and maintain group size depends more upon the young produced within the subpopulation, then from dispersal from an adjacent subpopulation. The current configuration of the population and its resilience to stochastic factors is best described at the subpopulation level. Population objectives and HMA delineation will be based on the subpopulation delineation. Subpopulation configuration is dynamic and should be reassessed using the following procedures every five years.

2. Procedure

On a map, identify all active and inactive clusters known in 1986 within the delineated population(s) involving Forest Service System lands. Segregate the groups into subpopulations using the following criteria.

In the absence of site-specific dispersal data, groups separated by more than 3 miles of currently unsuitable foraging habitat, or by greater than 5 miles of currently suitable foraging habitat, should be considered separate subpopulations. Include all inactive clusters within 3 to 5 miles of an active cluster, depending on the habitat condition between them. Those separated by 3 miles or less of currently unsuitable foraging habitat will be included. Those separated by 5 miles or less of currently suitable foraging habitat will also be included.

In this step, only inactive clusters meeting the glossary definition should be considered for inclusion. Some inactive clusters meeting these distance criteria should logically be excluded from the subpopulation. Examples are inactives on isolated tracts or long peninsulas of Forest Service land surrounded by permanently unsuitable habitat and other similar situations not conducive to long-term RCW management. All such exclusions must be reviewed and approved by the Regional Office. Inactive clusters not within the three to five mile distance from an active cluster should be placed into subpopulations using the same distance criteria used to delineate the active subpopulations.

All clusters, active and inactive, must be included within a subpopulation. Summarize, in tabular form, the number of isolated subpopulations delineated per population, and the number of active and inactive clusters in each. A subpopulation delineation example is shown in **Figure 4**.

The following is a step by step discussion of Figure 4:

All clusters, including the isolated inactive clusters in the southern tip, are included in one population - all clusters are less than 18 miles apart, and in no situation does a 5 mile or greater currently unsuitable foraging habitat barrier exist between clusters.

Subpopulation 2 is an aggregate of clusters more than 5 miles from the nearest cluster (9 miles between active clusters).

Subpopulation 3 is delineated because there is more than 5 miles between active clusters, even though a string of inactive clusters exists. The specific line separating Subpopulation 1 from Subpopulation 3 is somewhat subjective because of the string of inactive clusters and lack of habitat data. The inactive clusters were split between the two subpopulations.

Subpopulation 4 was delineated because a 3-mile separation of currently unsuitable foraging habitat exists between clusters.

Subpopulation 5 is delineated because more than 5 miles exist between clusters. This is considered a separate subpopulation even though active clusters do not exist.

E. DELINEATION OF RCW HABITAT MANAGEMENT AREAS

1. Background

The third step in setting RCW population objectives is to delineate the RCW habitat management area. HMAs will be delineated for all RCW subpopulations having one or more breeding pair(s), i.e., at least one male and female occupying the same cluster. On rare occasions, habitat conditions may warrant the exclusion of an active cluster from an HMA.

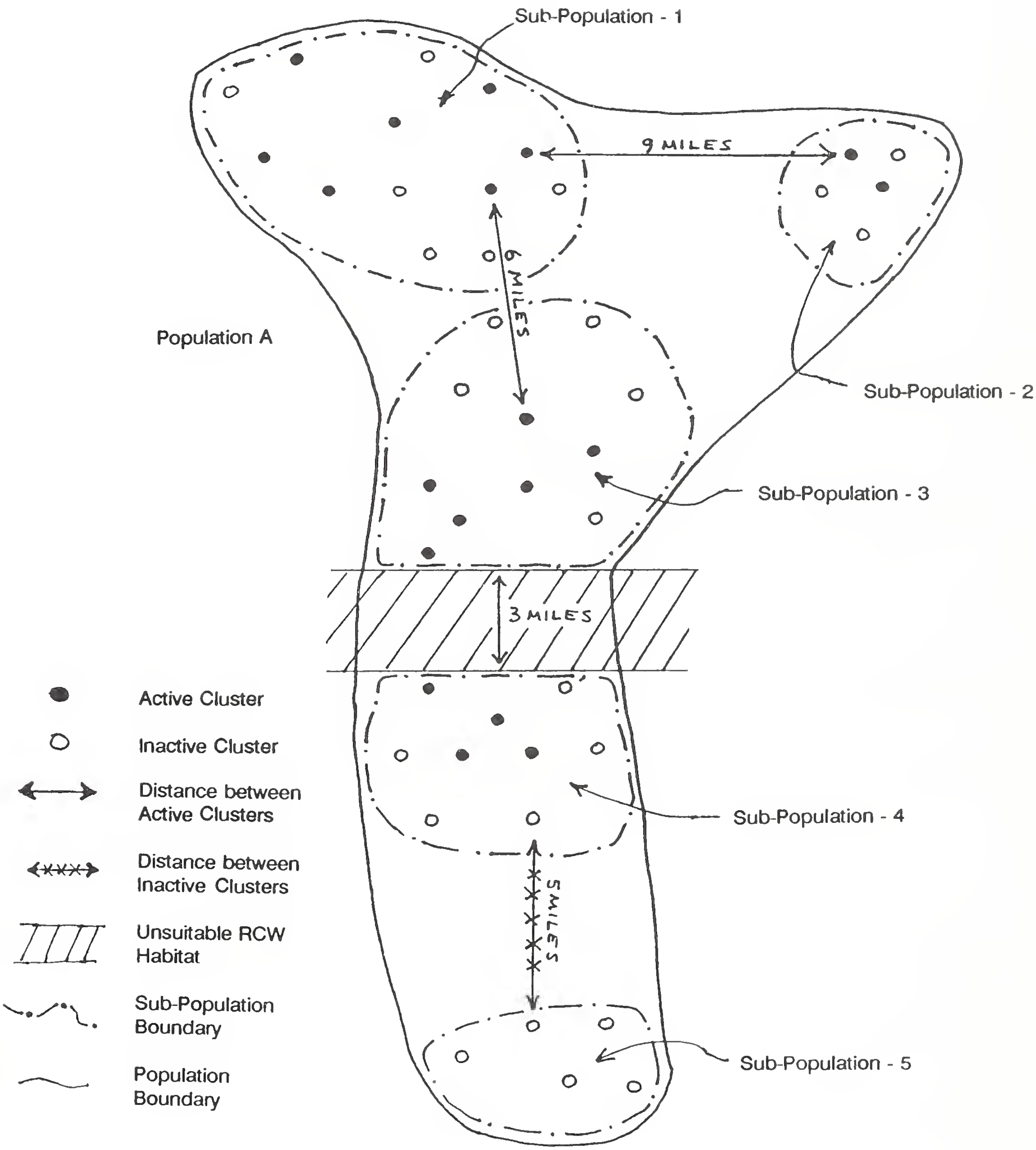
An example is an isolated group located on National Forest System land, but near the boundary. The adjacent private land is permanently unsuitable habitat and the group is also isolated from other Forest Service groups by permanently unsuitable habitat, i.e., a large hardwood river bottom. In such a case, a 3/4-mile radius circle would be drawn around the group. This area would be managed to sustain the RCW, knowing the group will eventually go extinct. Any young produced would be trapped and used to augment single-bird groups in other HMAs.

Such exclusions of active clusters from an HMA should occur only after all potential means of linkage (land acquisition, easements, etc.) have been explored. Such exclusions will require full National Environmental Policy Act and Endangered Species Act compliance, including consultation with the Fish and Wildlife Service. HMAs may also be established in areas that historically held RCW, but are currently unoccupied.

The HMA describes the future or desired population configuration, while the isolated subpopulation delineation describes the current configuration. The objective is to consolidate the isolated subpopulations within the HMA into a contiguous RCW population.

A long-term objective of linking isolated HMAs should also be considered, if land ownership and suitable RCW habitat is conducive to such a linkage. If such linkages are considered, suitable RCW habitat includes pine and pine-hardwood forest types, regardless of age, which have the potential to provide at least minimal RCW foraging habitat (at least 30 basal area of pine that is approximately 30 years old or older per acre. See Glossary (Chapter 6) for detailed definition. The HMA is a long-term commitment to RCW management with relatively inflexible boundaries. It may become a management area or set of management areas in Forest Plans.

Figure A-4
Subpopulation Delineation



2. Procedure

Delineation of the HMA is based on the configuration of the isolated subpopulations, total cluster distribution, and availability of suitable RCW habitat as defined in the previous paragraph. An individual HMA should have sufficient acres of suitable RCW habitat to support at least 50 groups. The greater the number of isolated subpopulations that can be interlinked and included within a HMA, the more effective and viable the population would become. Subpopulations separated by 18 miles or less of potentially suitable RCW habitat could be included within the same HMA.

Subpopulations, which are separated by 3 miles or more of permanently unsuitable RCW habitat, (includes lakes, agricultural lands, hardwood forest, river bottoms, as well as pine and pine-hardwood types that do not have the potential to produce suitable foraging habitat such as short rotation industrial forest land) should not be included in the same HMA.

Non-National Forest land may be considered suitable RCW habitat and included within an HMA only if easements, cooperative agreements, etc., ensure it will be properly managed and available for an extended period of time (several decades). The HMA boundary should coincide with administrative, topographic, and timber management boundaries (stands and compartments). An HMA boundary should not be closer than 1/2 mile and preferably 3/4 mile from the geometric center of a cluster. This would ensure effective RCW recruitment around those clusters. HMAs that link isolated subpopulations or aggregates of clusters within the same subpopulations, should be at least 2.5 miles wide, or should approximate the width of the subpopulations/aggregate of clusters being linked. Linkages of this width will ensure that colonization can occur within the linkage area, which will facilitate effective dispersal and social interaction of RCW within and through the linkage.

Wilderness may or may not be included within an HMA, depending on a variety of situations. Generally, wilderness management (no management) is not conducive to providing quality RCW habitat. However, if an individual Forest develops, gets approved and implements a wilderness management plan which will sustain acceptable habitat, the wilderness may be included within an HMA. Such a management plan would rely heavily on prescribed burning as its primary management tool, but may also need some other form of midstory control measures if existing midstory vegetation is too large to be readily controlled by fire.

Conversely, if the Forest is unwilling to develop and implement such a plan, the wilderness should not be included within an HMA.

In deciding whether or not to manage a wilderness for RCW, consideration should be given to the predominate forest type and other site specific conditions. For example, if longleaf is the predominate pine species and midstory is not yet a serious problem, burning alone will likely sustain quality RCW habitat. One the other extreme, attempting to sustain quality habitat on a mesic loblolly site may not be practical without adversely affecting wilderness characteristics.

When evaluating the compatibility of wilderness and RCW management, the following are key points:

- Is the proposed management in compliance with the appropriate guidelines (see FSM 2323.31b)?

- Can midstory vegetation be controlled with prescribed burning alone? This does not preclude potential initial control of midstory by some other method.

- Are site specific conditions, ie. forset type, moisture regime, etc., such that fire was historically a primary disturbance factor?

A positive answer to these questions indicates a high probability of wilderness and RCW management being compatible. In such cases, the Forests are encouraged to develop and implement appropriate wilderness management plans and to include wilderness within HMAs.

See **Figure 5** for an example of HMA delineation.

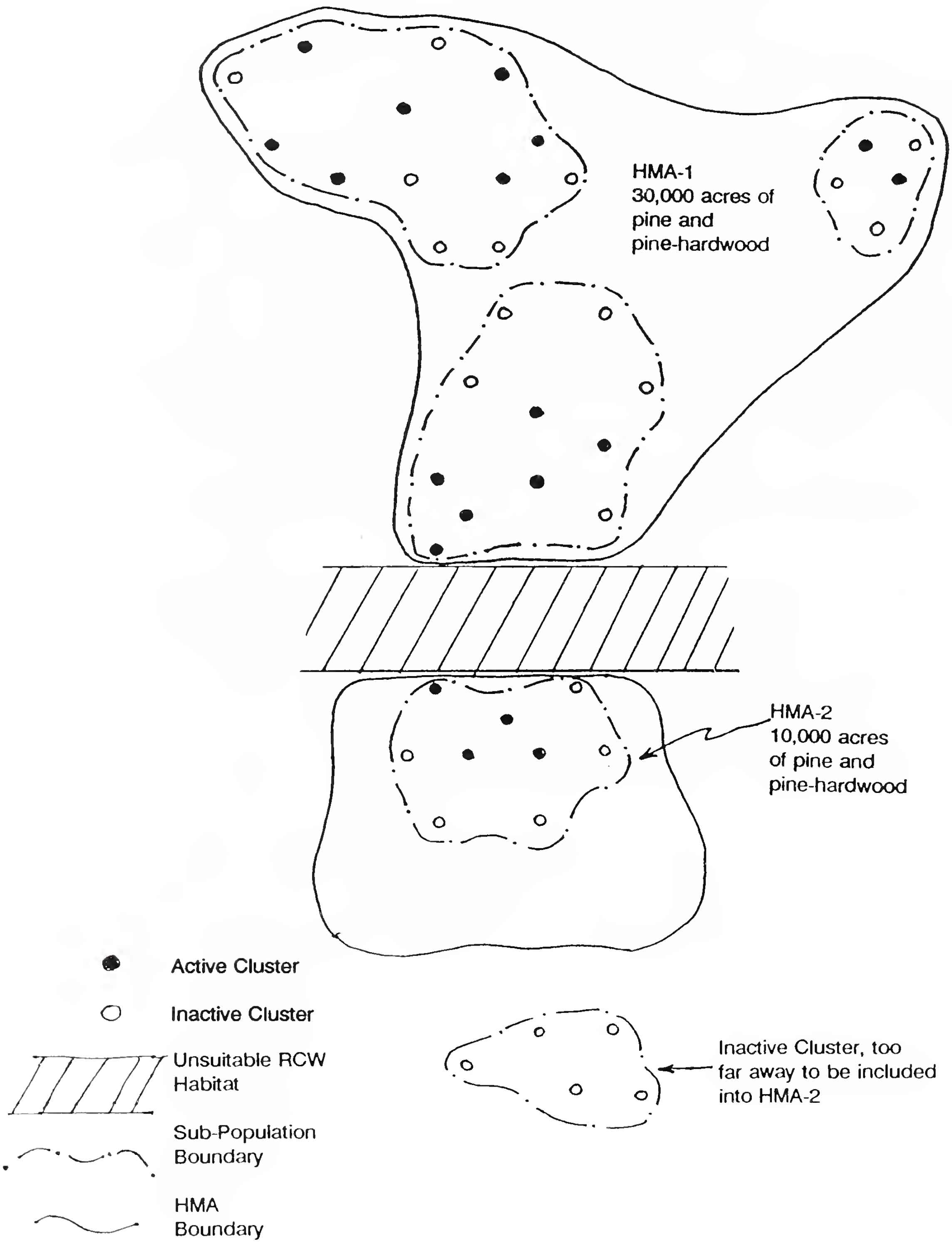
The following is a discussion of Figure 5:

Figure 5 shows the same cluster distribution as Figure 4. Subpopulations 1, 2, and 3 are grouped into one HMA which can support about 150 groups. Subpopulation 4 cannot be tied to HMA I because of the permanently unsuitable RCW habitat between Subpopulations 3 and 4.

The inactive Subpopulation 5 could be included in HMA II (would have to be if active), but in this case, it was considered an outlier group of clusters and it would be better to increase the contiguous acres within HMA II than to tie this group of inactive clusters to it.

Reasons to not include an inactive subpopulation would be: isolation, a lack of suitable habitat to link it to an HMA, insufficient acreage to achieve population objectives, or existing cluster distribution may not be the best configuration for recovery. HMA II can support 50 active clusters.

Figure A-5
Habitat Management Area (HMA) Delineation



F. SETTING POPULATION OBJECTIVES

1. Background

This is the final step in determining RCW population objectives. It is important that all the previous steps, delineating populations, isolated subpopulations and HMAs, be completed and documented. Points to consider when setting a population objective include the acres and distribution of suitable RCW habitat, quality of habitat, current population size, distribution of existing groups, isolated subpopulation configuration, land ownership patterns, overall recovery potentials, and recovery population responsibilities per the Fish and Wildlife Service RCW Recovery Plan.

Forest Service RCW population objectives must be set independent of adjacent land considerations. As discussed in the previous section, non-Forest Service land can be included within an HMA only if a cooperative agreement, memorandum of understanding, etc., exist, ensuring the landowner will manage their land in accordance with the RCW Recovery Plan. If such agreements exist, the population objective of the HMA can be determined, with documentation showing the Forest Service share of that objective.

With few exceptions, Forest Service administrative units with RCW groups have an existing population objective. Most of these were set in the 1985 Handbook. All of these will be reassessed as a part of this process. The current population objectives may change as the result of this reassessment.

The RCW Recovery Plan identifies 15 RCW populations over the bird's range that must be occupied by a long-term viable population to consider the RCW recovered. Twelve of these recovery populations are totally or partially dependent upon National Forest lands as the land base to support them. The recovery population areas and the National Forest administrative unit associated with them are shown on **Table A-1.**

Table A-1. National Forests with Recovery Population Responsibilities

PHYSIOGRAPHIC PROVINCE	NATIONAL FOREST
Alabama lower coastal plain	Conecuh NF
Alabama upper coastal plain	Oakmulgee R.D. of the Talladega NF
Alabama ridge and valley	Talladega/Shoal Creek R.D. Talladega NF
Florida lower coastal plain	Osceola NF
Florida panhandle l. coastal plain	Apalachicola NF
Georgia coastal plain	NONE
Georgia, North Carolina or South Carolina Piedmont	Oconee NF
Louisiana lower costal plain	Vernon RD, Kisatchie NF
Mississippi upper coastal plain	Bienville NF
Mississippi lower coastal plain	DeSoto NF
North Carolina lower coastal plain	Croatan NF
North Carolina sandhills	NONE
South Carolina lower coastal plain	Francis Marion NF
South Carolina sandhills	NONE
Texas lower coastal plain	Sam Houston NF

The RCW Recovery Plan states that a population size of at least 250 groups must be achieved before a population can be considered recovered. The Recovery Plan is unclear whether this number refers to total number of groups or the number which fledge young annually (reproducing population). Personal communication with Mike Lennartz and Gary Henry, preparers of the Recovery Plan (1985 Revision), indicate the number was intended to represent reproducing population.

To date, two populations have been evaluated for reproducing population status (North Carolina Sandhills and the Hitchiti/Piedmont Refuge). The results of these studies show that the number of potential breeding groups (mated pairs) needed to achieve a reproducing population size of 250 groups (successfully nesting annually) ranged from 310 groups in the Hitchiti/Piedmont Refuge (Heckel and Lennartz, personal communication) to 391 in the North Carolina Sandhills (Reed, et al., personal communication). The Fish and Wildlife Service has requested that we use (in the absence of population-specific nesting data) 400 as the number of potential breeding groups needed to achieve a reproducing population of 250. It was agreed at the March 1990 RCW Summit that up to 25 percent of the groups in a given population/subpopulation could be single birds; therefore, 500 active clusters (400 + [400 x .25]) are needed to achieve a reproducing population of 250.

Whenever possible, population-specific reproductive data should be used to calculate reproducing population size. However, in the absence of such data, the equivalents shown in **Table A-2** should be used.

Table A-2. Reproducing Population Size Equivalents

Reproducing Population	Potential** Breeding Pairs	Active*** Clusters	Genetic Viability****
25	40	50	Short-Term (100-300 years)
50	80	100	
125	200	250	Moderate (600-1500 years
250	400	500	Long-Term (1500-3000 years)

* Reproducing population size measured by the number of groups fledgling young annually, calculated by a running 5 year average.

** The number of potential breeding pairs in the population, does not include single bird groups.

*** The number of active clusters based on an ocular estimate of activity. It includes breeding groups, nonbreeding groups, and single-bird groups.

**** The general length of time before inbreeding and loss of genetic diversity can cause extinction. Uses 1.5 x Ne = probable time to extinction in generations (Soule 1980) with a RCW generation time of 4 years.

The RCW Recovery Plan identifies that population density objectives should fall within the range of 1 group per 200 to 400 acres of pine and pine-hardwood habitat. The population density that can be achieved is a function of habitat quality. The Forest Service is proposing this range be changed to 200 to 300 acres per RCW group. The logic being, if habitat quality is so poor it takes 400 acres to support a single group, its overall ability to support RCW may be marginal. The objective is to achieve as high a density as habitat quality will allow.

Table A-3 identifies the RCW density objectives that should be used in determining population objectives within the HMAs. Physiographic provinces are used to rank the general habitat quality for the RCW considering the proportion of suitable habitat available, the relative amount of pine versus pine-hardwood habitat, forest type, topographic relief, and habitat interspersion.

Table A-3. RCW Density Targets

PHYSIOGRAPHIC PROVINCE	DENSITY OBJECTIVE
Sou. Cumberland Plateau	1 group per 300 acres*
Interior Lower Highlands	1 group per 300 acres
Piedmont	1 group per 300 acres
Lower Coastal Plain	1 group per 200 acres
Ridge and Valley	1 group per 300 acres
Upper Coastal Plain	1 group per 250 acres
Ouachita Mountains	1 group per 300 acres

* Acres of suitable RCW habitat

2. Procedures

The following criteria sets the side boards in determining the population objective:

1. The population objective cannot be smaller than the current number of active clusters.

2. If identified as a recovery population, the population objective must be at least 250 (reproducing population) if the amount of suitable RCW habitat is sufficient to support such a population. In the absence of population specific reproductive data 400 potential breeding pairs or 500 total active clusters may be used **(see Table A-2)**.

   If the amount of suitable habitat can support more than 500 active clusters alternative HMA designs and sizes should be considered that provide for population objectives above the 500 active cluster level. Population objectives above the 500 active cluster level are encouraged if long term genetic viability, spatial subpopulation linkage, demographic functioning, or ability to withstand catastrophic impacts; e.g., hurricanes are significantly improved. Populations above the 250 reproducing groups may be considered "recovered" by the FWS and offer some ESA, Sections 7 and 9 advantages. Any HMA delineations that identify population objectives less than what the suitable habitat can support must be approved by the Regional Forester.

If the amount of suitable RCW habitat is insufficient to support a recovered population, the population objective becomes the maximum number of groups that can be supported based on the amount of suitable habitat available and the appropriate population density target. **See Table A-3.**

3. If one or more pair (a male and female) is present in the population, and it is not identified as a recovery population (a support population), the population objective must be at least 25 (reproducing population) or 50 active clusters for each HMA delineated. However, the HMA must be delineated per the process described in this appendix, therefore it may contain more acres of suitable RCW habitat than needed to support the minimum required population. In such cases, the population objective will be determined by dividing the total acres of suitable habitat within the HMA by the appropriate population density target **(Table A-3)**. If an HMA, delineated per this appendix, should contain less than the amount of suitable habitat to support the minimum required population, it must be expanded to include adequate acreage to support the minimum population.

4. All Forest Service subpopulations with one or more breeding pairs must be included within a HMA. Any subpopulation without at least one breeding pair will be evaluated on a case by case basis to determine how it should be managed. The evaluation will include appropriate National Environmental Policy Act and Endangered Species Act compliance, including consultation with the Fish and Wildlife Service.

5. If there are no active clusters in a subpopulation, and the amount of suitable RCW habitat on Forest Service System lands is insufficient to support at least one subpopulation with a reproducing population size of 25 groups (50 active clusters), RCW management is not appropriate. No HMA would be established and a population objective of zero should be assigned. If additional suitable RCW habitat on non-Forest Service land could be linked to the Forest Service System lands through a cooperative agreement, making the combined habitat sufficient to support a reproducing population of 25 groups (50 active clusters) or more, RCW management should be considered.

6. If there are no active clusters in the subpopulation and the amount of suitable RCW habitat on Forest Service System lands is sufficient to support at least one subpopulation with a reproducing population of 25 groups (50 active clusters), long-term RCW management can be implemented at the discretion of the Forest Supervisor. Population objectives would be either zero or a reproducing population size of 25 groups (50 active clusters) or larger.

The acreage needed to support a single RCW group varies by physiographic province. In general, habitat quality in the lower coastal plain is higher than that in the piedmont and mountains. Within physiographic provinces there is also variability in habitat capability based on ecological factors associated with individual landscapes. Soil properties, hydrology, and topographic features associated with a particular landscape can influence whether the resulting vegetation will be optimal, suitable, or marginal RCW habitat. For example, longleaf pine landscapes in the coastal plan will have a higher habitat capability than loblolly pine hardwood landscapes in the coastal plain. Because of this variability, each affected National Forest will refine the tentative population objectives established in the EIS for each of their HMAs, and establish final population objectives during the forest plan amendments or revision process. These refinements will be based on the following:

Acres of suitable and potentially suitable RCW habitat within permanent HMAs.

RCW density objectives for individual landscapes within a given National Forest.

Desired future condition of these habitats based on land type associations.

Generally, RCW population density objectives shall fall within the range of one group per 200 to 300 acres. However, it is recognized that some landscapes within a given HMA may require more acres per group. For example, wet loblolly pine-hardwood sites may require 400 acres and pond pine may require as much as 600 to 800 acres per group. No useable RCW habitat within an HMA should be excluded from RCW management, regardless of acres required to support a group.

The following are examples of how the above criteria could work.

Example 1. Support Population Objective

A tentative HMA in the coastal plain includes 50,000 acres of suitable RCW habitat. Based on a broad physiographic province density objective of 1 group per 200 acres, a tentative population objective of 250 groups would be identified. During the forest plan revision process a permanent HMA of 53,500 acres could be identified. Assume 80 percent of the HMA is longleaf pine and can support 1 group/200 acres; 15 percent of the HMA is loblolly pine and can support 1 group/250 acres; and 5 percent is loblolly pine hardwood and can support 1 group/275 acres. The HMA population objective would be 256 based on the above breakdown.

Example 2. Recovery Population Objective

A tentative HMA for a recovery population in the coastal plain includes 102,000 acres of suitable RCW habitat, and has a tentative population objective of 510 groups. During the forest plan revision process a permanent HMA of 99,000 acres is identified. Assume 90 percent of the HMA is longleaf pine and can support 1 group/200 acres; and 10 percent of the HMA is loblolly pine and can support 1 group/250 acres. The HMA population objective would be 486 based on the above breakdown. If any additional suitable RCW habitat exists on this forest, the permanent HMA must be increased in size to allow for a population objective of at least 500 groups.

The figures of 1 group/200 acres,1 group/250 acres, and 1 group/275 acres of longleaf, loblolly, and loblolly pine hardwood, respectively, were used for example purposes only. These values should not be viewed as established standards. Each individual Forest will need to develop their own RCW density objectives based on local conditions.

G. SUMMARY

The following is an outline of the steps in determining a RCW population objective:

Step 1 - Delineate the historic population by mapping the location of all known clusters on Forest Service System lands in 1986 and any known clusters on non-Forest Service land within 18 miles.

Step 2 - Map isolated subpopulations by identifying both active and inactive clusters, known in 1986, using specific distance criteria.

Step 3 - Delineate HMAs.

Step 4 - Determine the appropriate RCW density objectives

Step 5 - Calculate the RCW population objective for each HMA by dividing the total acres of suitable RCW habitat (pine and pine-hardwood, regardless of age) by the appropriate density objective (Step 4).

Step 6 - The total population objective equals the total of all the HMA population objectives for the respective population, if there is more than one HMA identified in the population.

Step 7 - Send the outputs (maps and numerical summaries) and supporting documentation of each of these steps to the Regional Office for review.

(The literature cited in this appendix is listed in Chapter 7, Literature Cited.)

APPENDIX B

Common and Scientific Names of Plants and Animals Mentioned Within the EIS.

American holly, (Ilex opaca).
American swallow-tailed kite, (Elanoides forficatus).
American beautyberry, (Callicarpa americana).
American redstart, (Setophaga ruticilla).
Aphodius tortise commensal scarab beetle, (Aphodius troglodytes).
Arrowfeather threeawn, (Aristida purpurascens).
Aster, (Aster spp.).
Bachman's sparrow, (Aimophila aestivalis).
Bank swallow, (Riparia riparia).
Black bear, (Ursus americanus).
Black and white warbler, (Mniotilta varia).
Blackberry, (Rubus spp.).
Blackeyed susan, (Rudeckecia hirita).
Blackgum, (Nyssa sylvatica).
Blue jay, (Cyanocitta cristata).
Blueberry, (Vaccinium spp.).
Bottlebrush threeawn, (Aristida spiciformis).
Brachen fern, (Pteridium aquilinum).
Broomsedge bleustem, (Andropogon viginicus).
Brown-headed nuthatch, (Sitta pusilla).
Brown-spot needle blight (Scirrhia acicola)
Carolina chickadee, (Parus carolinensis).
Chaffseed, (Schwabbea americana).
Chalky bluestem, (Andropogon capillipes).
Chuck will's widow, (Caprimulgus carolinensis).
Cinnimon fern, (Osmunda cinnamomea).
Cliff swallow, (Hirundo pyrrhonota).
Copris tortise commensal scarab beetle, (Copris gopheri).
Crabgrass, (Digitaria spp.).
Creeping bluestem, (Schizachyrium stoloniferum).
Curtis dropseed, (Sporobolus curtissii).
Deertongue, (Trilisa odoratissima).
Dogfennel, (Eupatorium capillifolium).
Dwarf live oak, (Quercus minima).
Eastern diamondback rattlesnake, (Crotalus adamanteus).
Eastern wild turkey, (Meleagris gallopavo).
Eastern screech owl, (Otus asio).
Eastern indigo snake, (Drymarchon carais couperi).
Eastern bluebird, (Sialia sialis).
Eastern glass lizard, (Ophisaurus ventralis).
Elm, (Ulmus spp.).
Florida skullcap, (Scutellaria floridana).
Florida burrowing owl, (Athene cunicularia floridana).
Flowering dogwood, (Cornus florida).
Fox squirrel, (Sciurus niger).
Gallberry, (Ilex glabra).

Goldenrod, (Solidago odora).
Gopher tortoise, (Gopherus polyphemus).
Gopher frog, (Rana spp.).
Grape, (Vitis spp.).
Grassleaf/silk-grass, (Heterotheca gramifolia).
Gray squirrel, (Sciurus carolinensis).
Gray fox, (Urocyon cinereoargenteus).
Great crested flycatcher, (Myiarchus crinitus).
Greenbrier, (Smilax rotundifolia).
Hawthorns, (Crataegus spp.).
Hickory, (Carya spp.).
Hispid cotton rat, (Sigmodon hispidus).
Honeysuckle, (Lonicera japonica).
Hooded warbler, (Wilsonian citrina).
Indigo bunting, (Passerina cyanea).
Jessamine, (Gelsemiun sempervirens).
Killdeer, (Charadrius vociferus vociferus).
Lespedeza, (Lespedezia striata).
Little bluestem, (Schizachyrium scoparium).
Lopside indiangrass, (Sorghastrum nutans).
Louisiana pearl shell mussel, (Margaritiferna hembeli).
Louisiana black bear, (Ursus a. luteolus).
NCN, (Dianthus deltoids).
Northern cardinal, (Cardinalis cardinalis).
Northern bobwhite, (Colinus virginianus).
Oak, (Quercus spp.).
Onthophagus tortoise commensal scarab beetle, (Onthophagus p. polyphemi).
Opossum, (Didephis virginiana).
Ovenbird, (Seiurus aurocapillus).
Painted bunting, (Passerina ciris).
Panicum, (Panicum spp.), (Dichanthelium spp.).
Partridge pea, (Cassia spp.).
Paspalum, (Paspalum spp.).
Persimmon, (Diospyros viginiana).
Pileated woodpecker, (Dryocopus pileatus).
Pine warbler, (Dendroica pinus).
Pine snake, (Pituophis spp.).
Pinehill bluestem, (Andropogon divergens).
Pineywoods dropseed, (Sporobolus junceus).
Prairie warbler, (Dendroica discolor).
Prickly pear cactus, (Opuntia humifusa).
Raccoon, (Procyon lotor).
Ragweed, (Ambrosia artemisiifolia).
Red maple, (Acer rubrum).
Red-eyed vireo, (Vireo olivaceus).
Red-heart fungus, (Phellinus pini).
Red fox, (Vulpes fulva).
Red-bellied woodpecker, (Melanerpes carolinensis).
Red-headed woodpecker, (Melanerpes erythrocephalus).
Redcedar, (Juniperus virginiana).

Rhychosia, (Rhychosia difformis).
Rosemary, (Conradina spp.).
Roughleaf loosestrife, (Lysimachia asperifolia).
Royal tern, (Sterna maximus).
Runner oak, (Quercus pumula).
Saw palmetto, (Sable minor).
Sherman's fox squirrel, (Sciurus n. shermani).
Slender bluestem, (Andropogon tener).
Snowy egret, (Egretta thula).
Southeastern American kestral, (Falco sparverius paulus).
Southern Flying squirrel, (Glaucomys volans).
Southern pine beetle, (Dendroctonus frontalis).
Southern magnolia, (Magnolia grandifolia).
Summer tanager, (Piranga rubra).
Swamp sunflower, (Helianthus angustifolius).
Sweetgum, (Liquidambar styraciflua).
Tephrosia (Tephrosia spp.).
Tickclover, (Desmodium spp.).
Titi, (Cliftonia monophylla, Cyrillia racemiflora).
Tufted titmouse, (Parus bicolor).
Viburnum, (Viburnum spp.).
Wax myrtle, (Myrica cerifera).
White-footed mouse, (Peromyscus leucopus).
White-eyed vireo, (Vireo griseus).
White-tailed deer, (Odocoileus virginianus).
Wiregrass/pineland threeawn, (Aristida stricta).
Yankeeweed, (Eupatorium compostifolium).
Yaupon, (Ilex vomitoria).
Yellow-throated warbler, (Dendroica dominica).
Yellow-breasted chat, (Icteria virens).
Yellow poplar, (Liriodendron tulipifera).

APPENDIX C

Proposed, Endangered, Threatened, or Sensitive species known to occur or likely to occur in RCW habitats or micro-habitats within RCW habitat.

PLANTS

Common Name	Scientific Name	Federal Status*
COASTAL PLAIN FALSE FOXGLOVE	Agalinus aphylla	
THIN-STEMMED FALSE FOXGLOVE	Agalinus filicaulis	
INCISED GROOVEBUR	Agrimonia incisa	C2
LOUISIANA BLUESTAR	Amsonia ludoviciana	3C
PINE-WOODS BLUESTEM	Andropogon arctatus	
NODDING NIXIE	Apteria aphylla	
SOUTHERN THREE-AWNED GRASS	Aristida simpliciflora	C2
SAVANNA MILKWEED	Asclepias pedicellata	
SOUTHERN MILKWEED	Asclepias viridula	C2
CAROLINA SPLEENWORT	Asplenium heteroresiliens	C2
CHAPMAN'S ASTER	Aster chapmanii	C2
ASTER	Aster concolor	
THISTLE-LEAVED ASTER	Aster eryngiifolius	C2
GROUND-PLUM	Astralagus crassicarpus	
COASTAL PLAIN WILD INDIGO	Baptisia simplicifolia	C2
TOOTHED SAVORY	Calamintha dentata	
BEARDED GRASS-PINK	Calopogon barbatus	
CHAPMAN'S SEDGE	Carex chapmanii	C2
COAST SEDGE	Carex exilis	
CYPRESS SWAMP SEDGE	Carex joorii	
PENNSYLVANIA SEDGE	Carex pennsylvanica	
CHINQUAPIN	Castanea pumila	
HAIRY LIP FERN	Cheilanthes lanosa	
ROSEBUD ORCHID	Cleistes divaricata	
PIGEON WINGS	Clitoria fragrans	T
PIEDMONT JOINTGRASS	Coelorachis tuberculosa	C2
APALACHICOLA ROSEMARY	Conradina glabra	E
UMBRELLA SEDGE	Cyperus grayioides	C2
PINK LADY'S SLIPPER	Cypripedium acaule	
NORTHERN BUSH-HONEYSUCKLE	Diervilla lonicera	
EASTERN PURPLE CONEFLOWER	Echinacea purpurea	
TEXAS PIPEWORT	Eriocaulon texense	
LONG-LEAVED WILD BUCKWHEAT	Eriogonum longifolium	
SCRUB WILD BUCKWHEAT	Eriogonum longifolium var. gnaphalifolium	T
MANY-FLOWERED WILD BUCKWHEAT	Eriogonum multiflorum	
LUCY BRAUN'S WHITE SNAKEROOT	Eupatorium luciae-brauniae	C2
ERECT MILK-PEA	Galactia erecta	
PINE BARREN GENTIAN	Gentiana autumnalis	
WIREGRASS GENTIAN	Gentiana pennelliana	C2
SOAPWORT GENTIAN	Gentiana saponaria	
LOBLOLLY BAY	Gordonia lasianthus	

CONT. PLANTS

Common Name	Scientific Name	Federal Status*
HARPER'S BEAUTY	Harperocallis flava	E
MOCK PENNYROYAL	Hedeoma graveolens	C2
SUNFLOWER	Helianthus atrorubens	
SLENDER HELIOTROPE	Heliotropium tennellum	
PANHANDLE SPIDERLILY	Hymenocallis henryae	C2
MYRTLE HOLLY	Ilex myrtifolia	
LARGE WHORLED POGONIA	Isotria verticillata	
THICK-LEAVED WATER WILLOW	Justicia crassifolia	C2
BOG BUTTON	Lachnocaulon digynum	C2
SLENDER GAY-FEATHER	Liatris tenuis	C2
PINE LILY	Lilium catesbaei	
PANHANDLE LILY	Lillium iridollae	C2
PONDBERRY	Lindera melissifolia	E
BOG SPICEBUSH	Lindera subcoriacea	C2
SLENDER LEAVED DRAGON HEAD	Linum sulcatum	C2
WEST'S FLAX	Linum westii	C2
NODDING CLUBMOSS	Lycopodium cernuum	
ROUGHLEAF LOOSESTRIFE	Lysimachia asperifolia	E
SWAMP LOOSESTRIFE	Lysimachia terrestris	
WHITE BIRD-IN-A-NEST	Macbridia alba	T
HUMMINGBIRD FLOWER	Macranthera flammea	
BOG MOSS	Mayaca aubletii	
SANDWORT	Minuartia glabra	
GODFREY'S SANDWORT	Minuartia godfreyi	C2
FALL-FLOWERING IXIA	Nemastylis floridana	C2
FLORIDA BEARGRASS	Nolina atopocarpa	C2
BRITTON'S BEARGRASS	Nolina brittoniana	E
(no common name)	Oxypolis ternata	C2
NAKED-STEMMED PANICUM	Panicum nudicaule	C2
KIDNEY-LEAF	Parnassia asarifolia	
CAROLINA GRASS-OF-PARNASSUS	Parnassia caroliniana	C2
LGEFLOWERED GRASS OF PARNASSUS	Parnassia grandifolia	
DRUMMOND NAILWORT	Paronychia drummondii	
WHITE ARUM	Peltandra sagittaefolia	
CUPLEAF BEARDTONGUE	Penstemon murrayanus	
PINE BARREN'S PRAIRIE-CLOVER	Petalostemon gracilis	
CLIMBING HEATH	Pieris phillyreifolia	
GODFREY'S BUTTERWORT	Pinguicula ionantha	T
CHAPMAN'S BUTTERWORT	Pinguicula planifolia	C2
SOUTHERN BUTTERWORT	Pinguicula primuliflora	
BENT GOLDEN ASTER	Pityopsis flexuosa	C2
CRESTED FRINGED ORCHID	Platanthera cristata	
YELLOW FRINGELESS ORCHID	Platanthera integra	
WHITE FRINGELESS ORCHID	Platanthera integrilabia	C2
CLAMMY WEED	Polansia erosa	

CONT. PLANTS

Common Name	Scientific Name	Federal Status*
SMALL LEWTON'S POLYGALA	Polygala lewtonii	E
PURPLE MILKWORT	Polygala polygama	
SOUTHERN JOINTWEED	Polygonella americana	
JOINTWEED	Polygonella polygama	
ROUGH RATTLESNAKE-ROOT	Prenanthes aspera	
BARBED RATTLESNAKE-ROOT	Prenanthes barbata	C2
SMOOTH-LIPPED EULOPHIA	Pteroglossaspis ecristata	C2
ARKANSAS OAK	Quercus arkansana	
SMALL-FLOWERED MEADOWBEAUTY	Rhexia parviflora	C2
PANHANDLE MEADOWBEAUTY	Rhexia salicifolia	C2
MICHAUX'S SUMAC	Rhus michauxii	E
LARGE BEAKRUSH	Rhynchospora macra	
BOG SABINE CONEFLOWER	Rudbeckia scabrifolia	C2
LARGE-LEAVED ROSE GENTIAN	Sabatia macrophylla	
PARROT PITCHER PLANT	Sarracenia psittacina	
WHERRY'S PITCHER PLANT	Sarracenia rubra wherryi	C2
CHAFFSEED	Schwalbea americana	E
FLORIDA SKULLCAP	Scutellaria floridana	T
SPIKEMOSS	Selaginella riddellii	
GENTIAN PINKROOT	Spigelia gentianoides	E
GIANT SPIRAL ORCHID	Spiranthes longilabris	
GREAT PLAINS LADIES TRESSES	Spiranthes magnicamporum	
NAVASOTA LADIES TRESSES	Spiranthes parksii	E
EASTERN FEATHERBELLS	Stenanthium gramineum	
SMALL-FLOWERED FLAME FLOWER	Talinum parviflorum	
PINELAND HOARY PEA	Tephrosia mohrii	C2
GOAT-RUE	Tephrosia spicata	
BUSH PEA	Thermopsis fraxinifoli	
BRISTLE FERN	Trichomanes boschianum	
LARGE CRANBERRY	Vaccinium macrocarpon	
CHAPMAN'S CROWNBEARD	Verbesina chapmanii	C2
YELLOW VIOLET	Viola tripartite	
DRUMMOND'S YELLOW-EYED GRASS	Xyris drummondii	C2
KRAL'S YELLOW-EYED GRASS	Xyris longisepala	C2
HARPER'S YELLOW-EYED GRASS	Xyris scabrifolia	C2
VIPERINA	Zornia bracteata	

ANIMALS

Common Name	Scientific Name	Federal Status*
MAMMALS		
RED WOLF	Canus rufus	E
FLORIDA PANTHER	Felis concolor coryi	E

CONT. MAMMALS

Common Name	Scientific Name	Federal Status*
EASTERN COUGAR	Felis concolor couguar	E
SOUTHERN PYGMY SHREW	Microsorex hoyi winnemana	3C
FLORIDA LONG-TAILED WEASEL	Mustela frenata peninsulae	C2
SOUTHEASTERN MYOTIS	Myotis austroriparius	C2
GRAY BAT	Myotis grisescens	E
INDIANA BAT	Myotis sodalis	E
EASTERN SMALL-FOOTED BAT	Myotis leibii	C2
EASTERN WOODRAT	Neotoma magister	C2
FLORIDA MOUSE	Peromyscus floridanus	C2
RAFINESQUE'S BIG-EARED BAT	Plecotus rafinesquii	C2
VIRGINIA BIG-EARED BAT	Plecotus townsendii virginianus	E
SHERMAN'S FOX SQUIRREL	Sciurus niger shermani	C2
BLACK BEAR	Ursus americanus	
FLORIDA BLACK BEAR	Ursus americanus floridanus	C1
LOUISIANA BLACK BEAR	Ursus americanus luteolus	T

BIRDS

Common Name	Scientific Name	Federal Status*
BACHMAN'S SPARROW	Aimophila aestivalis	C2
FLORIDA BURROWING OWL	Athene cunicularia floridana	
PEREGRINE FALCON	Falco peregrinus	E
SOUTHEASTERN AMERICAN KESTREL	Falco sparvarius paulus	C2
MISSISSIPPI SANDHILL CRANE	Grus canadensis pulla	E
BALD EAGLE	Haliaeetus l. leucocephalus	T
LOGGERHEAD SHRIKE	Lanius ludovicianus	C2
RED-COCKADED WOODPECKER	Picoides borealis	E

REPTILES

Common Name	Scientific Name	Federal Status*
EASTERN DIAMONDBACK RATTLESNAKE	Crotalus adamanteus	
EASTERN INDIGO SNAKE	Drymarchon carais couperi	T
BLUE-TAILED MOLE SKINK	Eumeces egregius lividus	T
GOPHER TORTOISE	Gopherus polyphemus	T
SOUTHERN HOG-NOSED SNAKE	Heterodon simus	C2
MOLE SNAKE	Lampropeltis calligaster	
APALACHICOLA KING SNAKE	Lampropeltis getulus goini	
SAND SKINK	Neoseps reynoldsi	T
BLACK PINE SNAKE	Pituophis melanoleucus lodgingi	C2
NORTHERN PINE SNAKE	Pituophis melanoleucus melanoleucus	C2
FLORIDA PINE SNAKE	Pituophis melanoleucus mugitus	C2
LOUISIANA PINE SNAKE	Pituophis melanoleucus ruthveni	C2
SHORT-TAILED SNAKE	Stilosoma extenuatum	C2

AMPHIBIANS

Common Name	Scientific Name	Federal Status*
FLATWOODS SALAMANDER	Ambystoma cingulatum	C2
PINE BARRENS TREEFROG	Hyla andersonii	

CONT. AMPHIBIANS

Common Name	Scientific Name	Federal Status*
SOUTHERN RED-BACK SALAMANDER	Plethodon serratus	
FLORIDA GOPHER FROG	Rana areolata aesopus	C2
CAROLINA GOPHER FROG	Rana areolata capito	C2
DUSKY GOPHER FROG	Rana areolata sevosa	C1

INSECTS

APHODIUS TORTOISE SCARAB BEETLE	Aphodius troglodytes	C2
COPRIS TORTOISE SCARAB BEETLE	Copris gopheri	C2
SAY'S SPIKETAIL DRAGONFLY	Cordulegaster sayi	C2
TORTOISE COMMENSAL NOCTUID MOTH	Idia gopheri	C2
AMERICAN BURYING BEETLE	Nicrophorus americanus	E
ONTHOPHAGUS TORTOISE SCARAB BEETLE	Onthophagus polyphemi	C2
OCALA BURROWING BEETLE	Peltotrupes youngi	C2
VARIEGATED CLUBTAIL DRAGONFLY	Progomphus bellei	C2
TORTOISE COMMENSAL NOCTUID MOTH	Schinia rufipinna	C2
CALVERT'S EMERALD DRAGONFLY	Somatocholora claverti	
SCRUB PALMETTO SCARAB BEETLE	Trigononpelastes floridana	C2

ARACHNIDS

ROSEMARY WOLF SPIDER	Lycosa ericeticola	

E—Endangered

T—Threatened

P—Proposed for listing by the USFWS as threatened or endangered

C1—Taxa for which the USFWS has on file enough substantial data on biological vulnerability and threats to support proposals to list them as threatened or endangered species.

C2—Taxa for which information now in the possession of the USFWS indicates that proposed listing as threatened or endangered is possibly appropriate, but for which conclusive data on biological vulnerability or threats are not currently available.

3C—Taxa that have proven to be more abundant or widespread than previously believed and/or those that are not subject to any identifiable threat.

Those species included in the appendix that do not have any federal status listed are considered Forest Service Sensitive.

There are a total of 178 species (122 plants, 56 animals) listed above in appendix C. These species evolved with the red-cockaded woodpecker and their population declines were likely caused by the same factors: habitat loss, habitat fragmentation, alteration of natural disturbance regimes, and fire control. The proposed ecological approach to red-cockaded woodpecker recovery should benefit most if not all species on the above list.

APPENDIX D

TENTATIVE HABITAT MANAGEMENT AREA MAPS

The shaded areas on the following set of maps show the tentative habitat management areas (HMA) for all national forest which currently have RCW populations. The maps are small but do give the reader an idea of where and how large the tentative HMAs are. All maps are not the same scale. HMA boundaries will not be finalized until the individual Forest Plans are amended/revised to fully incorporate the new RCW management direction. Larger, more detailed maps will be developed at that time.

Due to the small scale, some tracts of private land within the national forest boundaries may be shaded in. Such private lands **will not** be affected by the proposed RCW management direction.

Table D-1 shows the acreage associated with each tentative HMA. The acreage figures represent the acres of pine and pine-hardwood forest within the shaded area, not the gross acres.

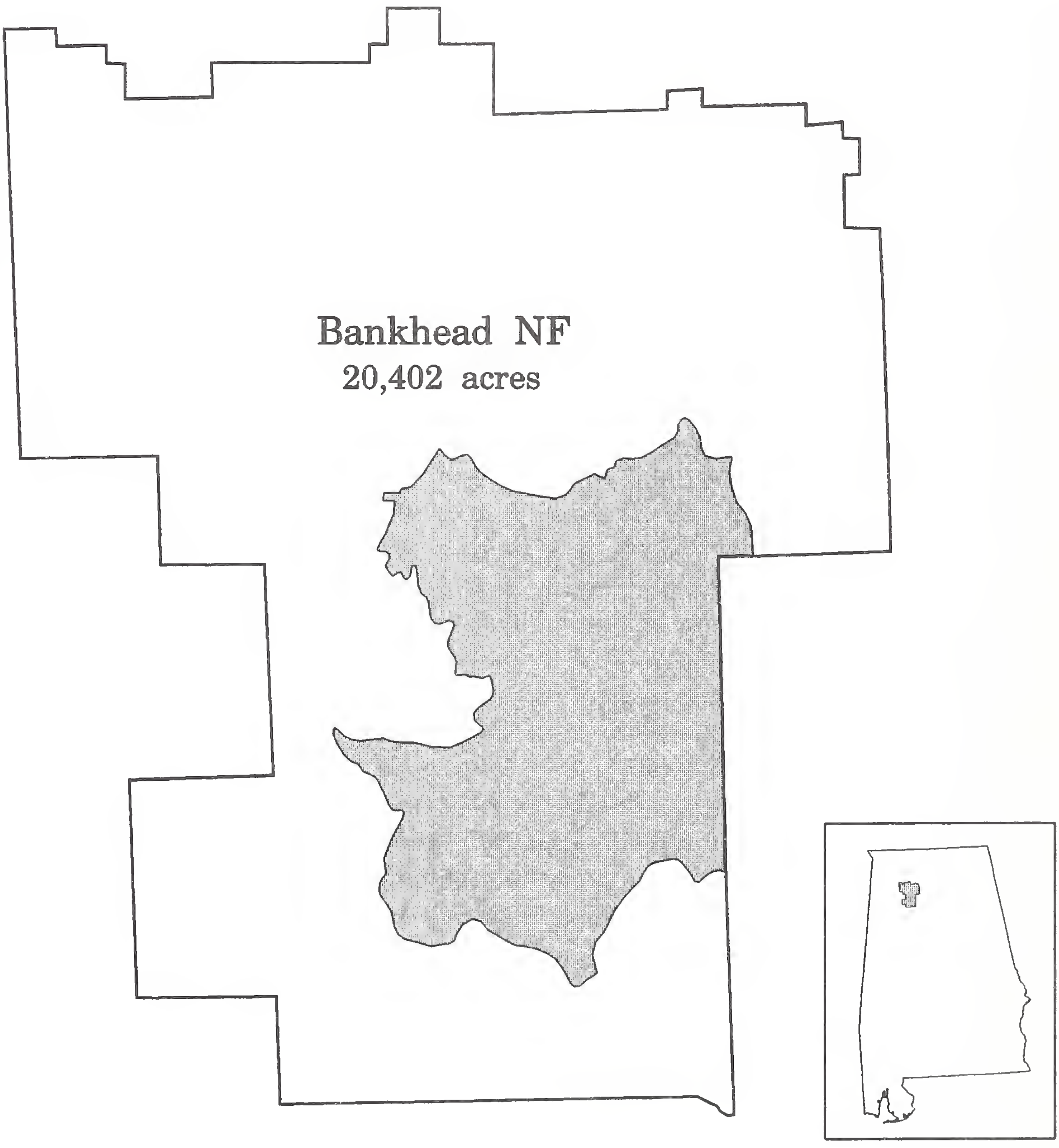
Table D-1

Tentative Habitat Management Areas (HMA).

Tentative HMAs are based on the distribution of existing active and inactive clusters (colony sites) rather than the current RCW population.

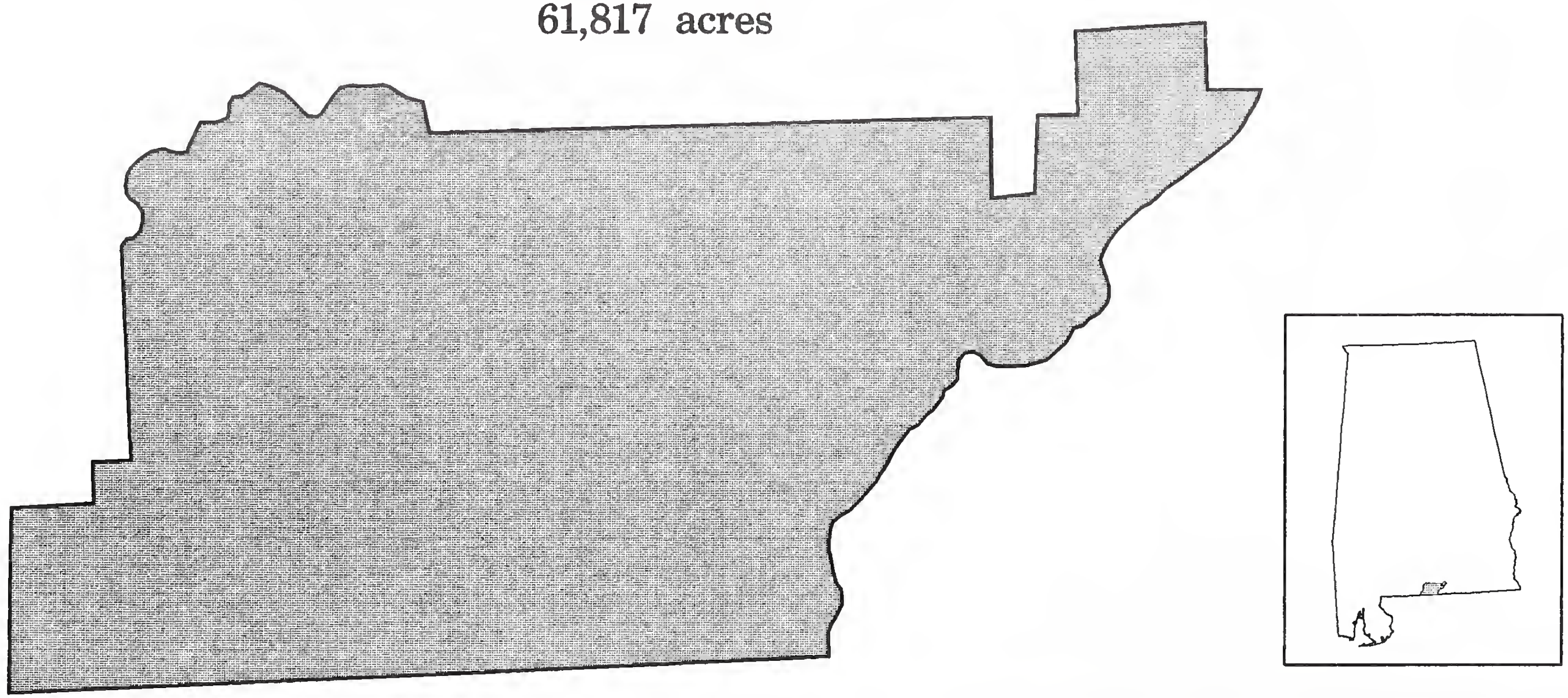
STATE	National Forests with HMAs (Recovery Pop. Und.)	Tentative HMA Area (Acres)
ALABAMA	Bankhead	20,402
	Conecuh	61,817
	Talladega-Oakmulgee RD	98,584
	Talladega/Shoal Creek RD	124,247
		305,050
ARKANSAS	Ouachita	68,521
FLORIDA	Apalachicola-	
	Apalachicola RD	141,263
	Wakulla RD	144,368
	Ocala	48,400
	Osceola	98,183
		432,214
GEORGIA	Oconee/Hitchiti **	52,966
KENTUCKY	Daniel Boone	48,487
LOUISIANA	Kisatchie-	
	Catahoula RD	65,734
	Evangeline RD	46,298
	Kisatchie RD	59,267
	Vernon RD	64,243
	Winn RD	56,297
		291,839
MISSISSIPPI	Bienville	125,160
	DeSoto-	
	Biloxi RD	38,293
	Black Creek RD	35,467
	Chickasawhay RD	100,494
	Homochitto	67,755
		367,169
N.CAROLINA	Croatan	27,940
S.CAROLINA	Francis Marion	125,351
TENNESSEE	Cherokee	6,150
TEXAS***	Angelina/Sabine	66,286
	Davy Crockett	65,016
	Sam Houston	105,194
		236,496
SOUTHERN REGION		1,962,183

– Tentative –
Red–Cockaded Woodpecker Habitat Management Areas

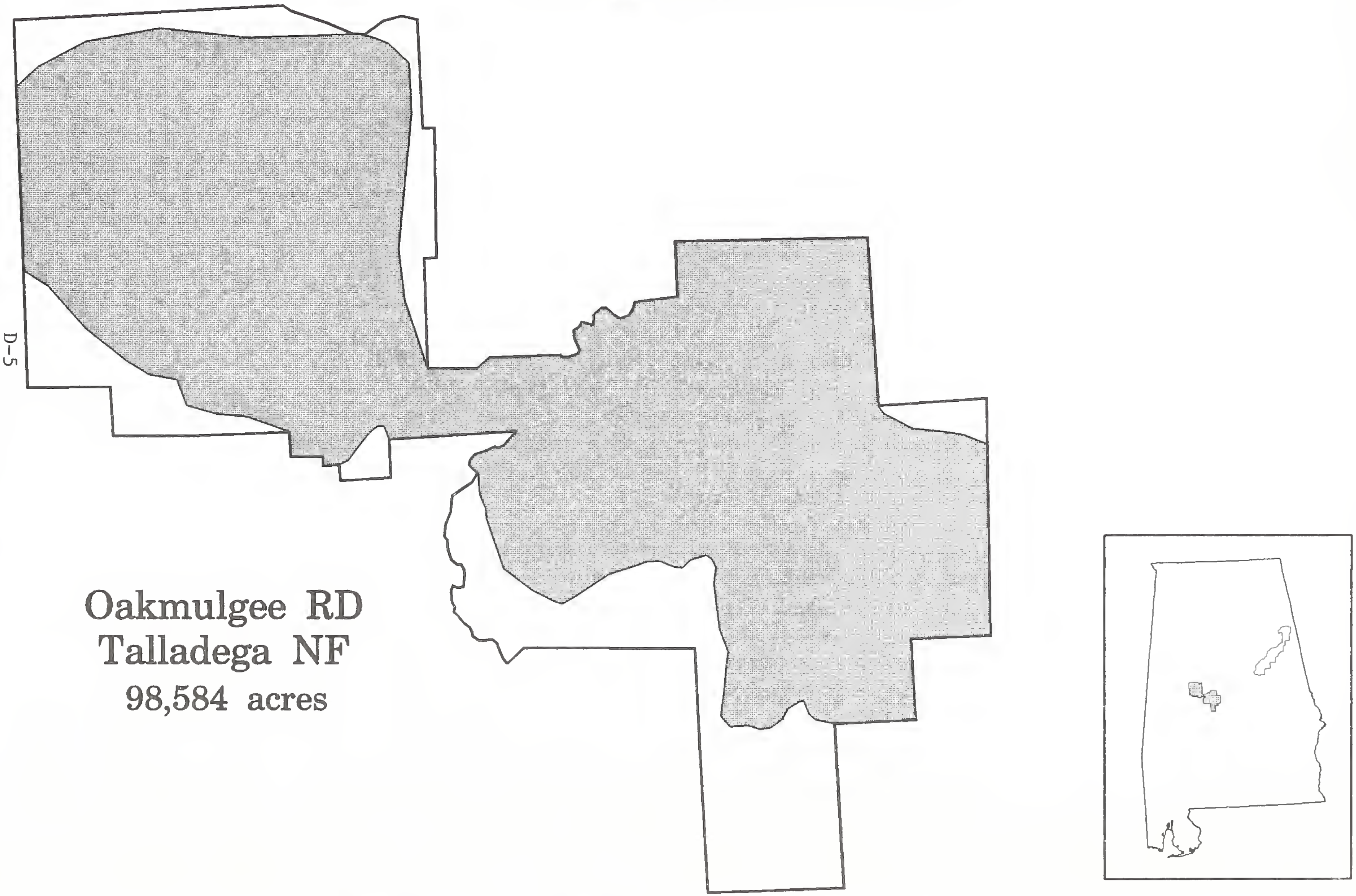


– Tentative –
Red–Cockaded Woodpecker Habitat Management Areas

Conecuh NF
61,817 acres

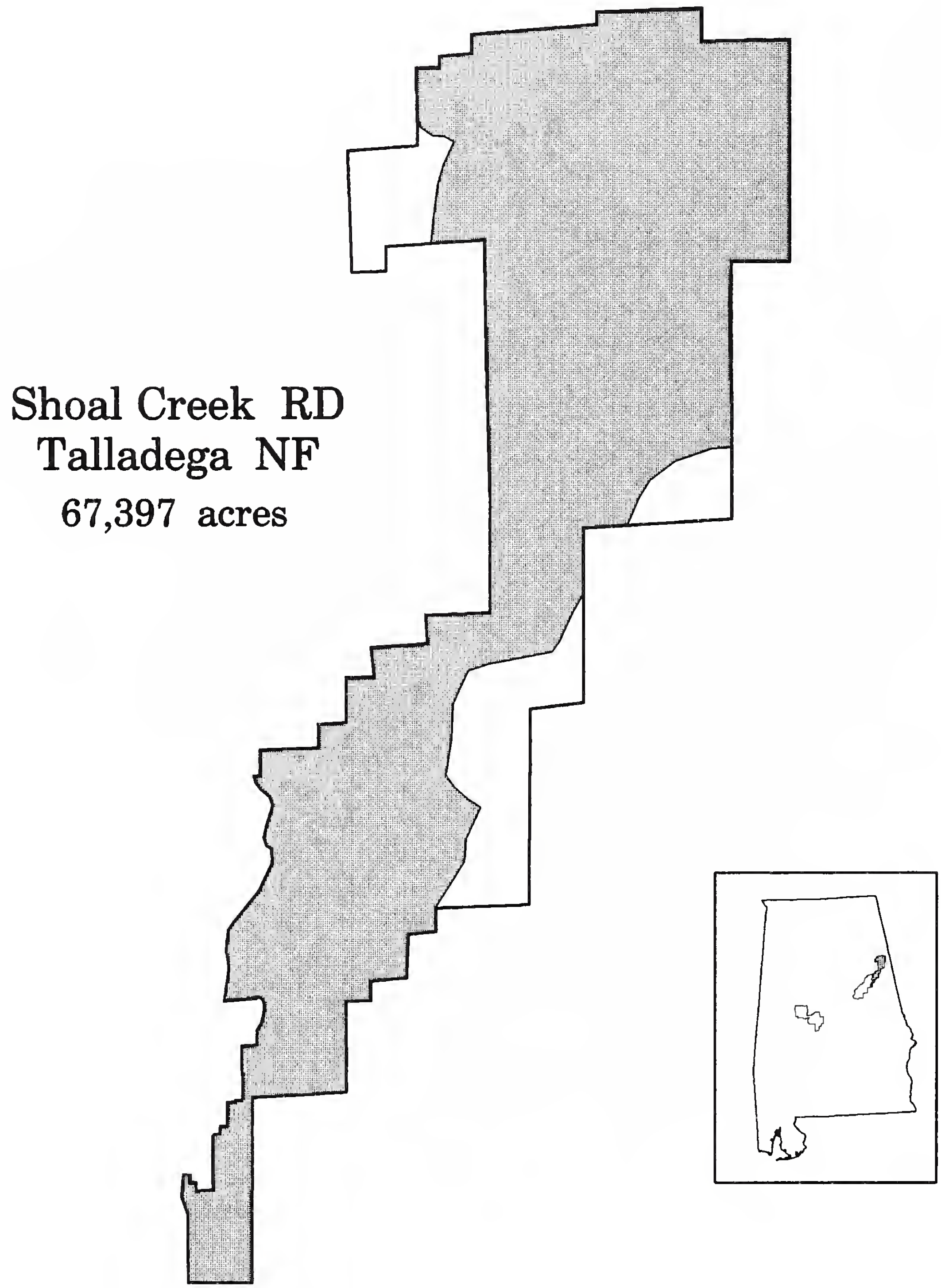


– Tentative –
Red–Cockaded Woodpecker Habitat
Management Areas

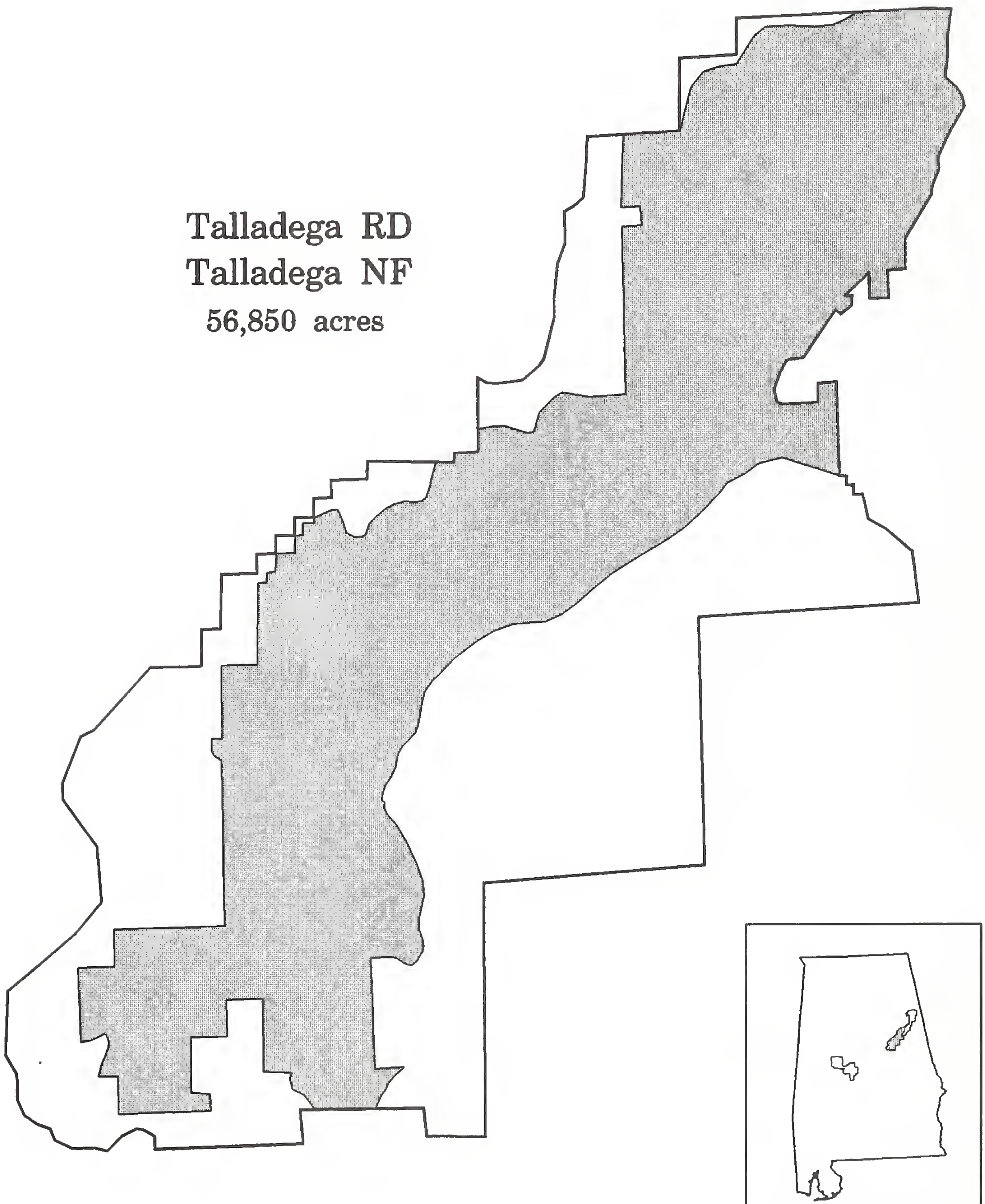


Oakmulgee RD
Talladega NF
98,584 acres

– Tentative –
Red–Cockaded Woodpecker Habitat Management Areas



– Tentative –
Red–Cockaded Woodpecker Habitat Management Areas



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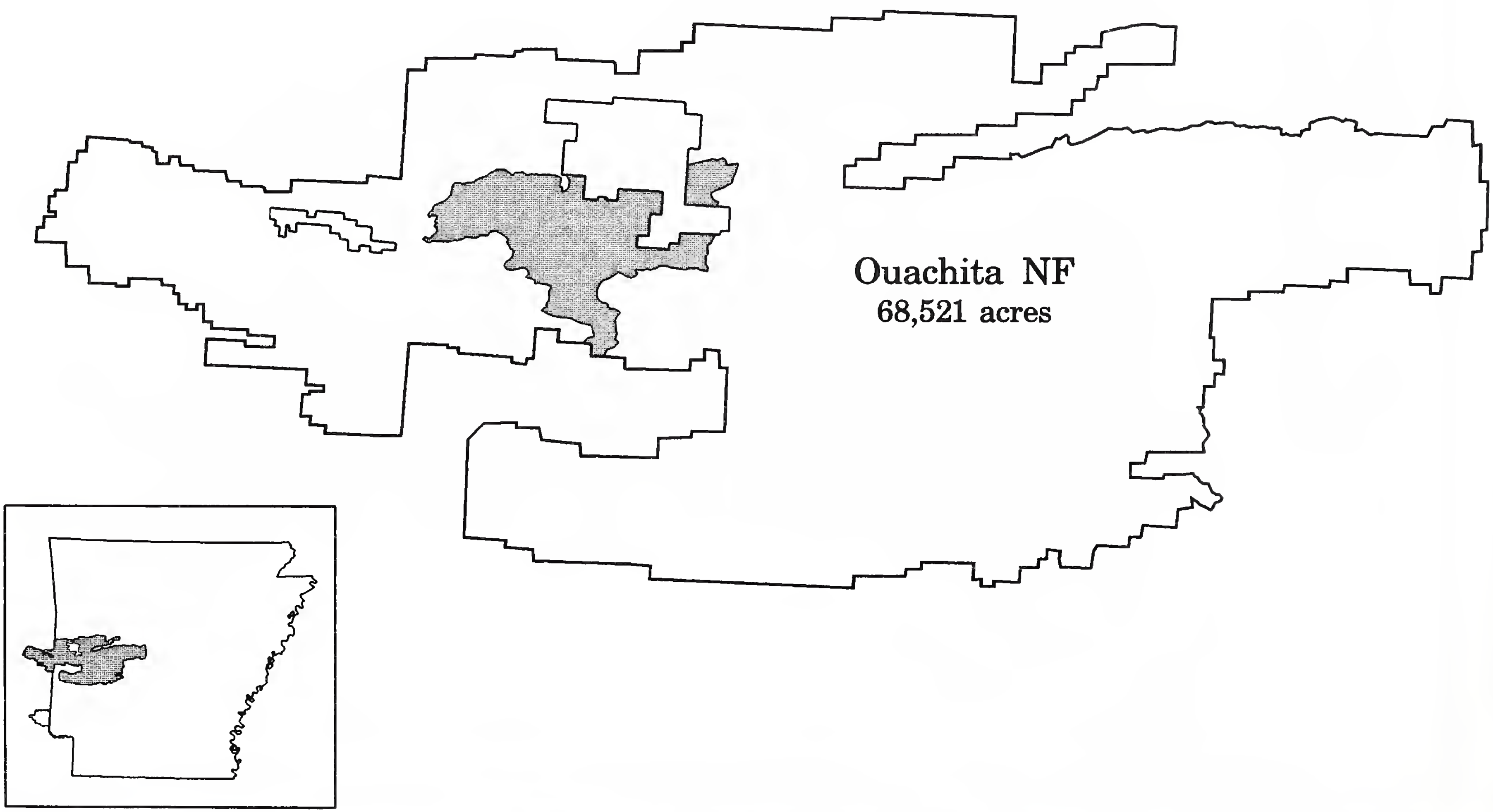
Red–Cockaded Woodpecker Habitat Management Areas



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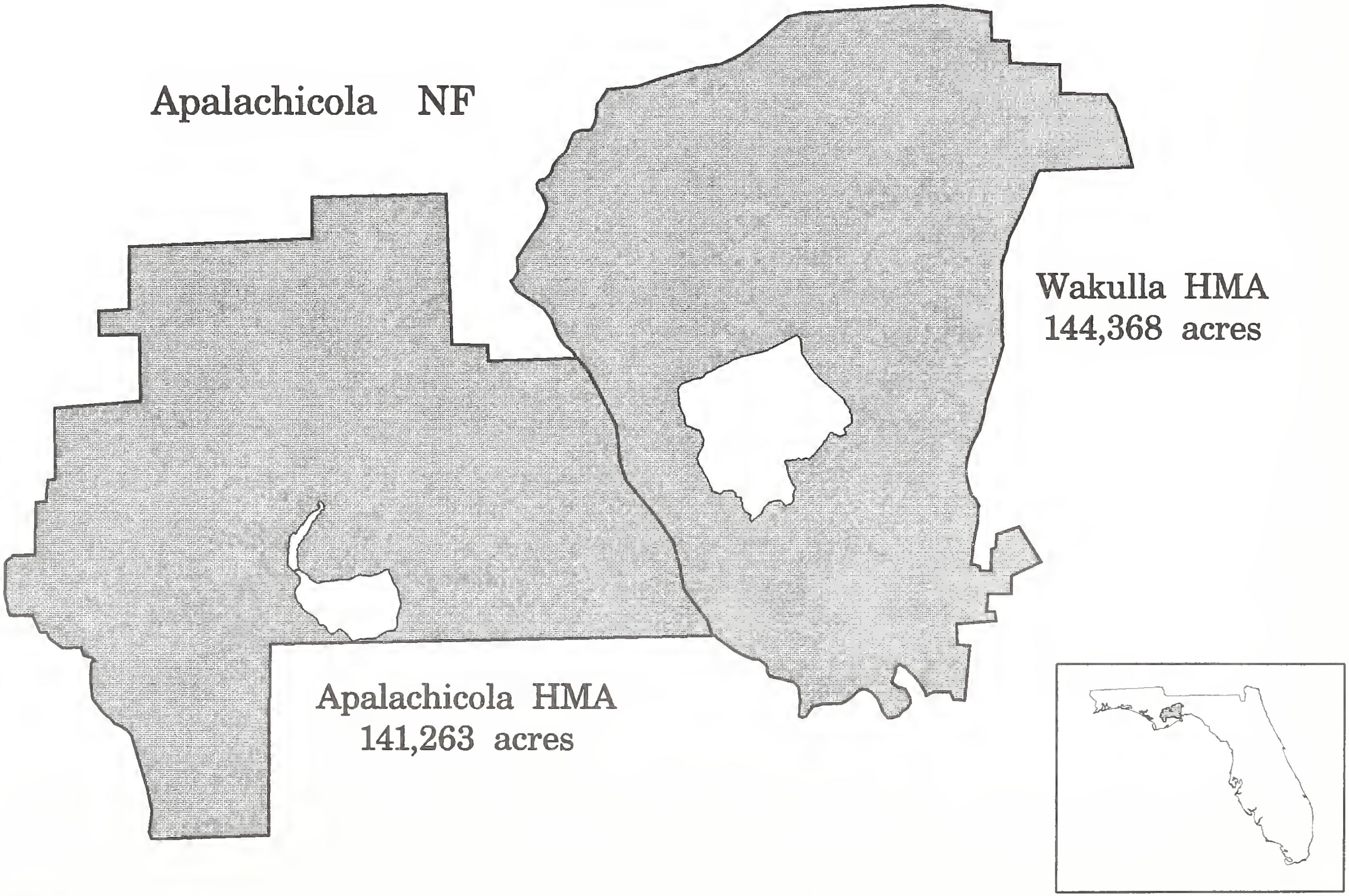
Red–Cockaded Woodpecker Habitat Management Areas



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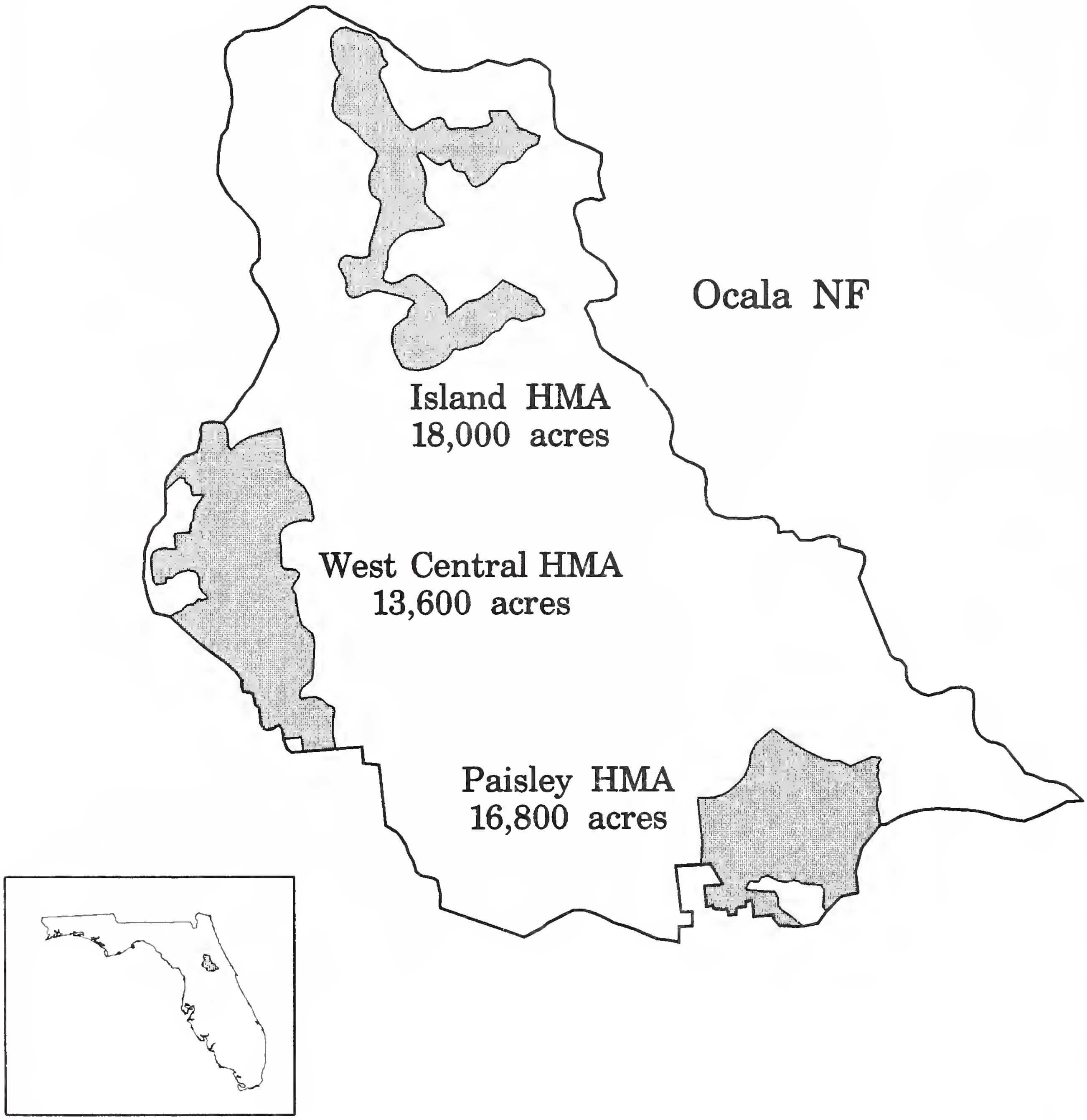
Red-Cockaded Woodpecker Habitat Management Areas



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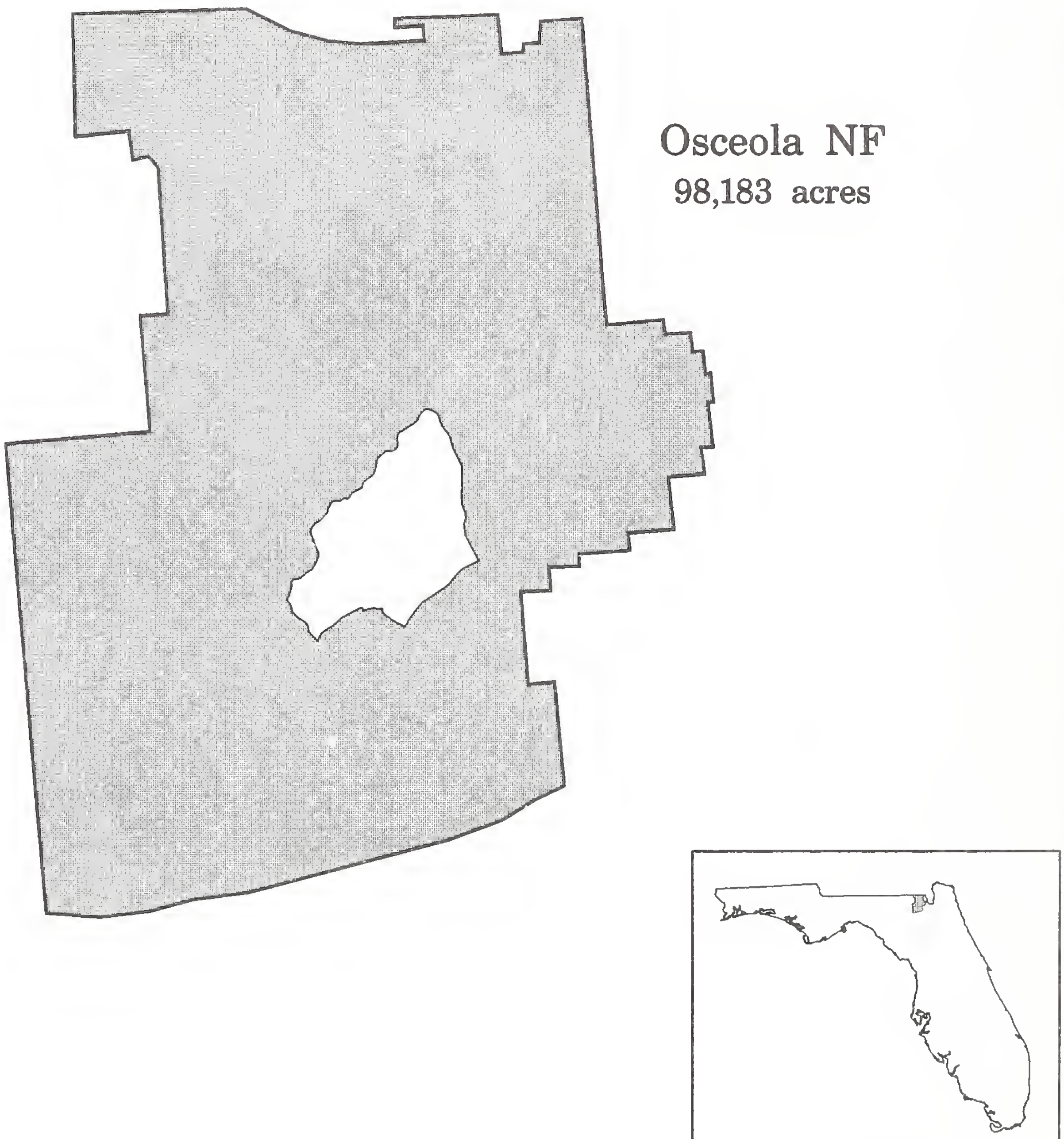

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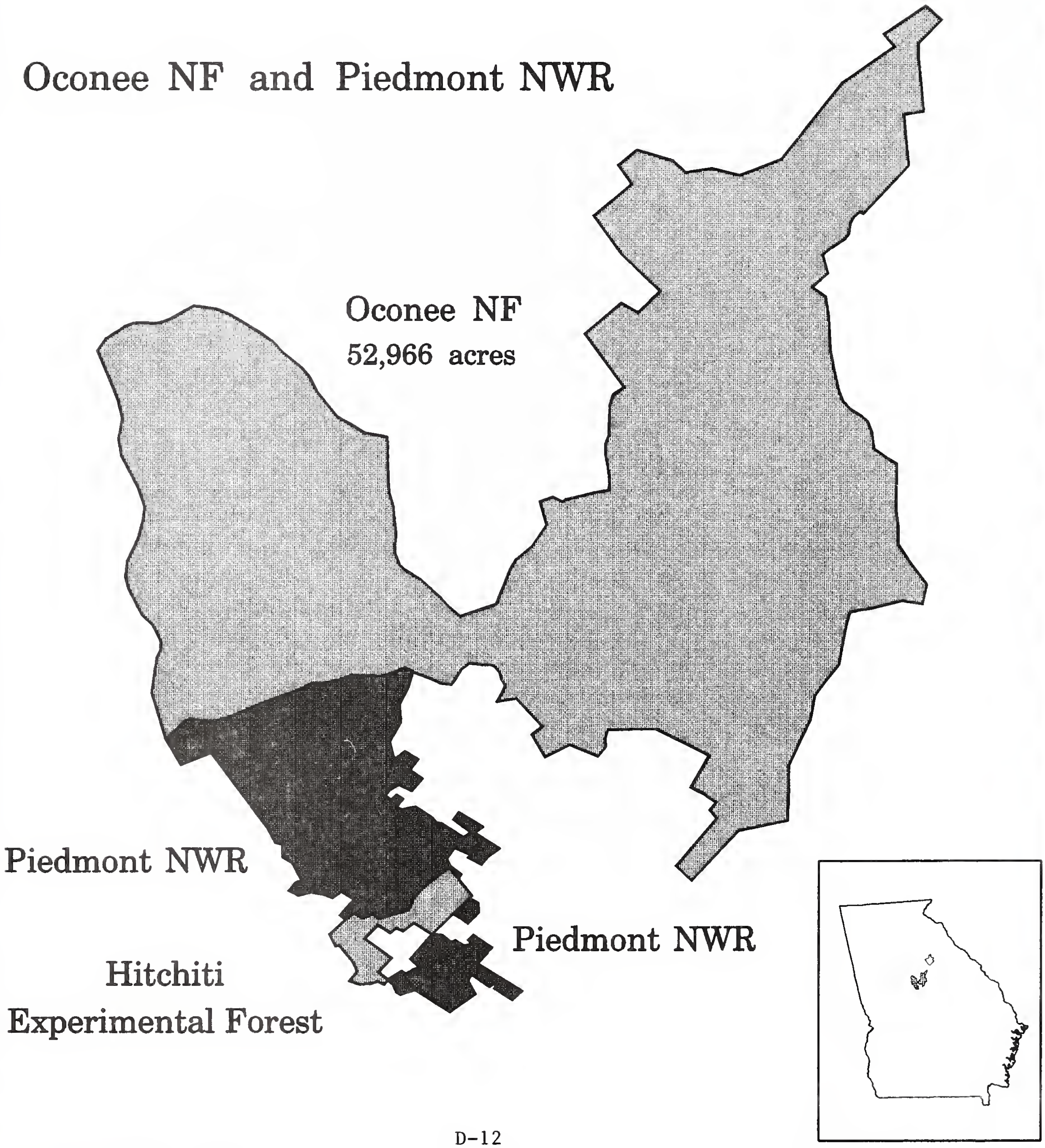
Red–Cockaded Woodpecker Habitat Management Areas



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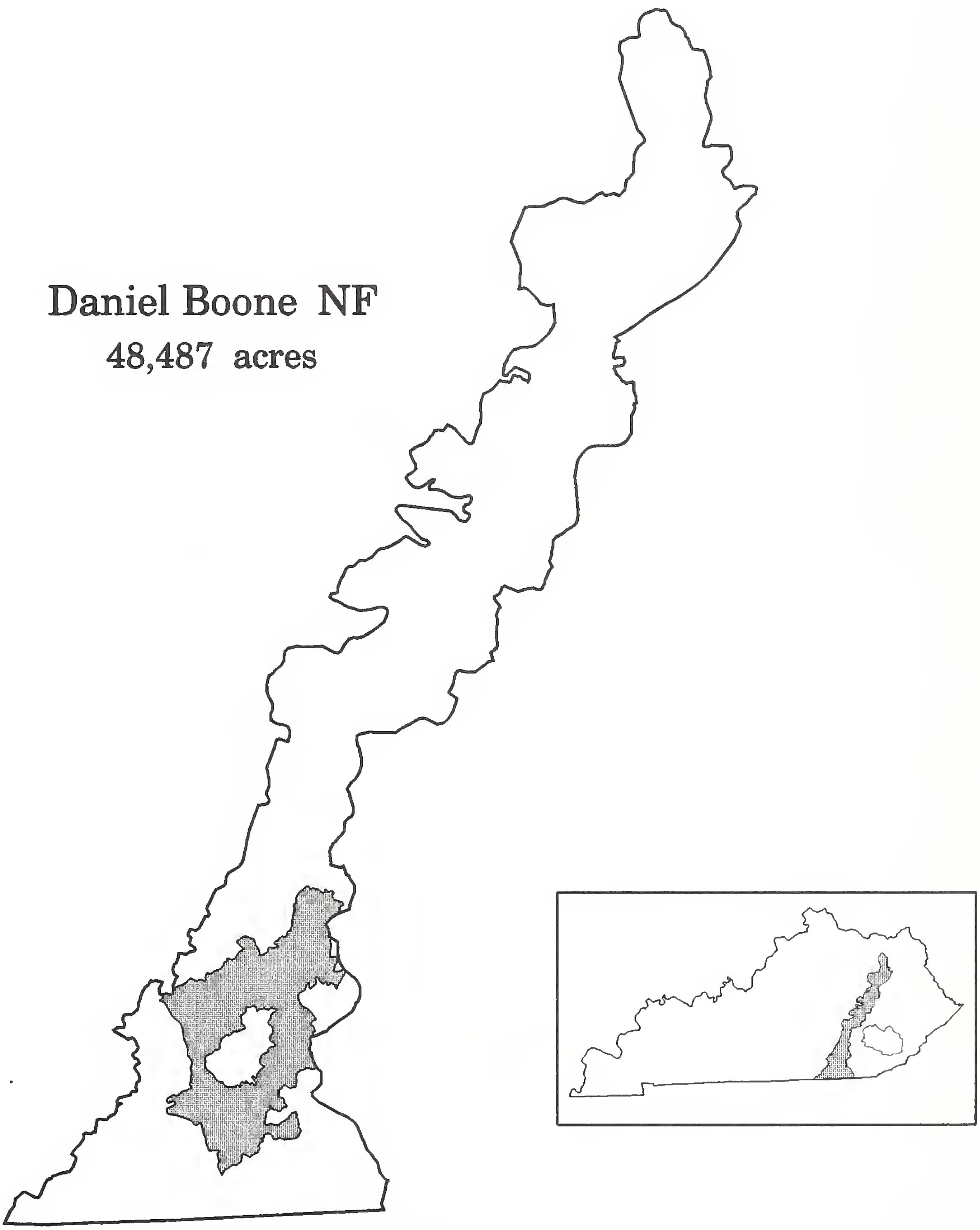
Red–Cockaded Woodpecker Habitat Management Areas



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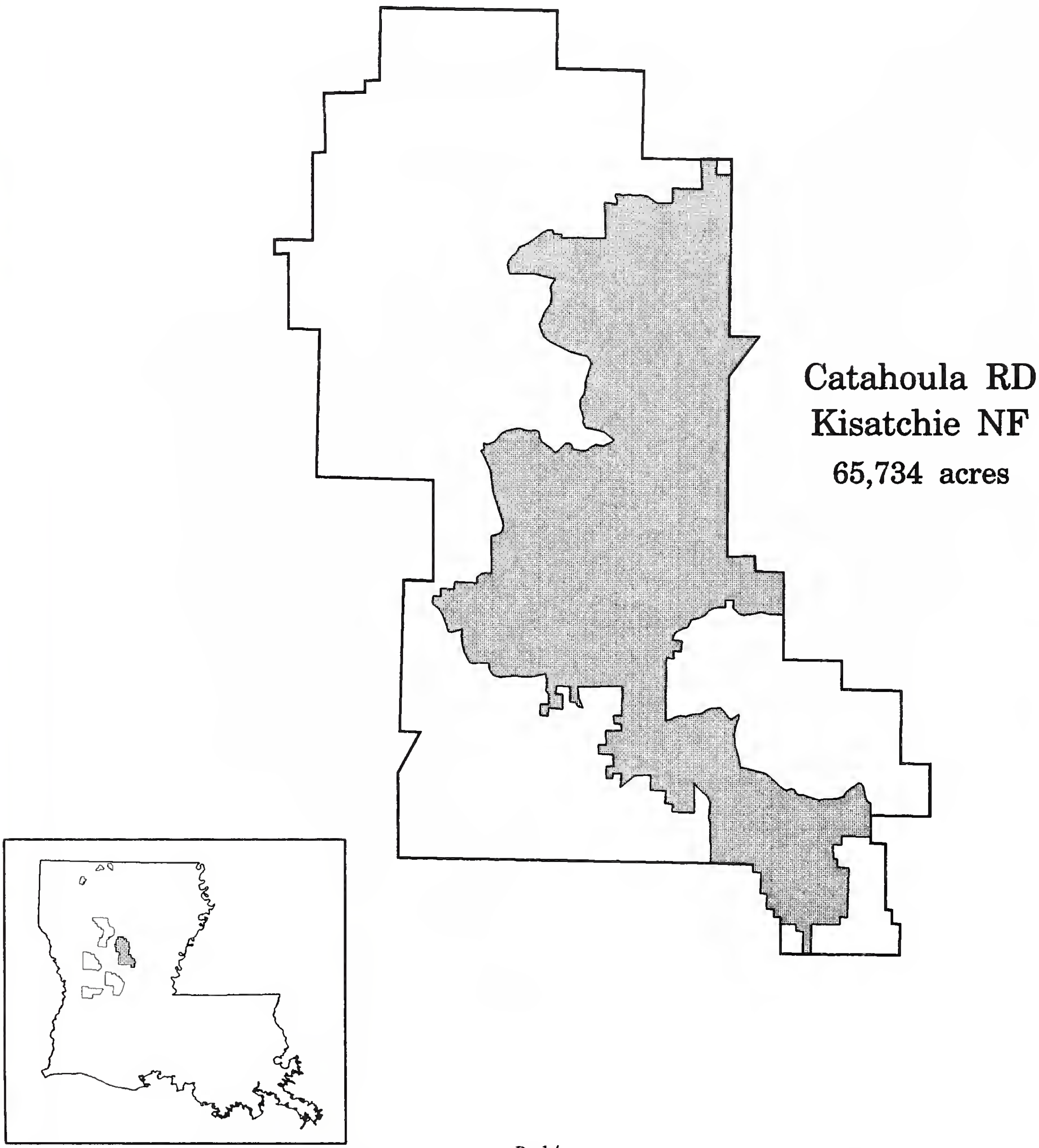
Red–Cockaded Woodpecker Habitat Management Areas



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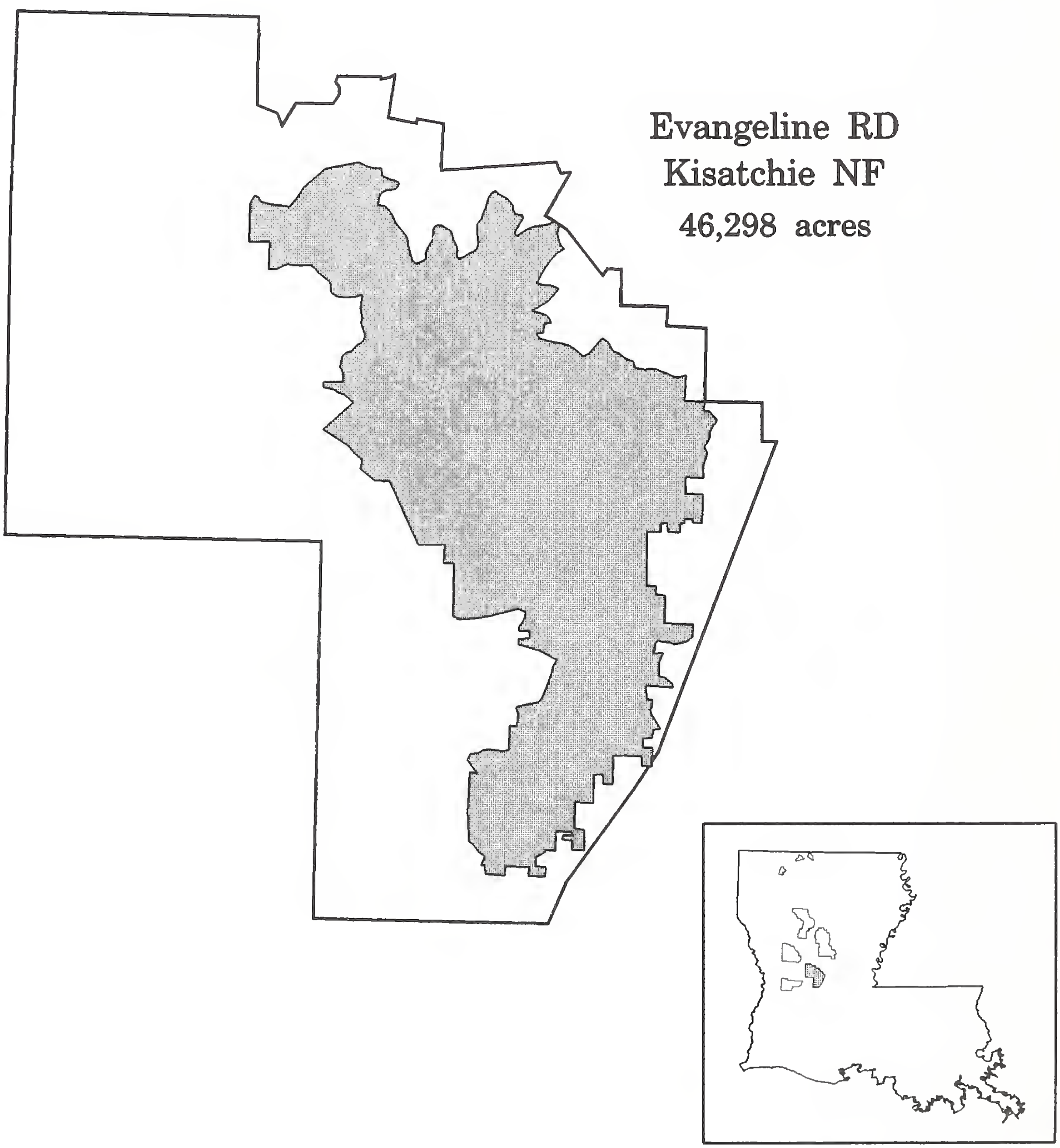
Red–Cockaded Woodpecker Habitat Management Areas



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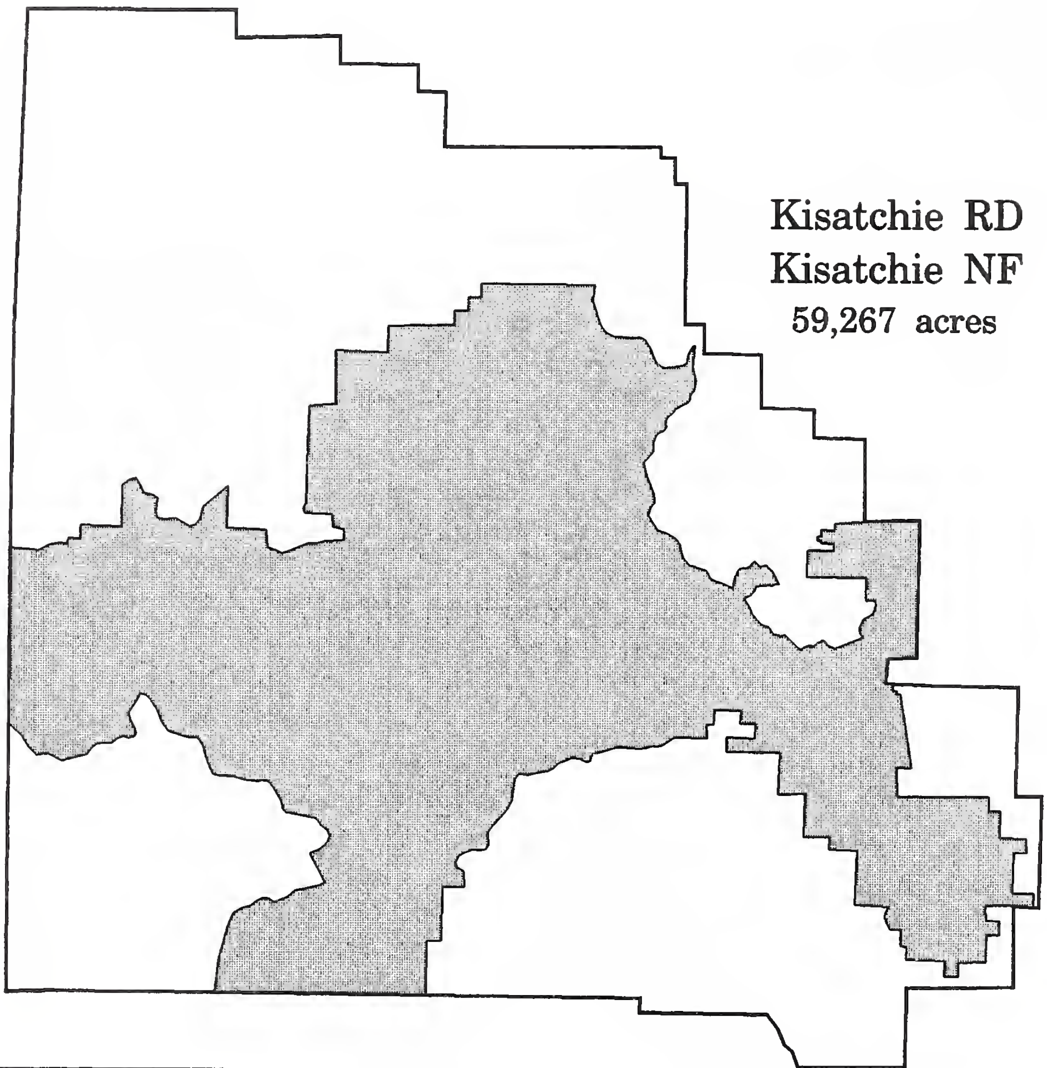
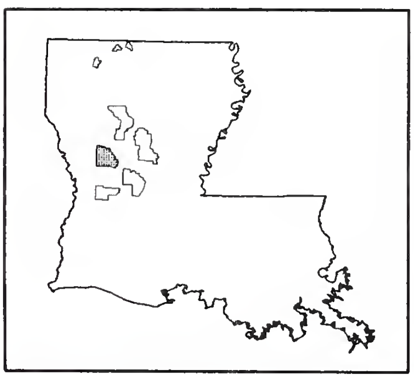
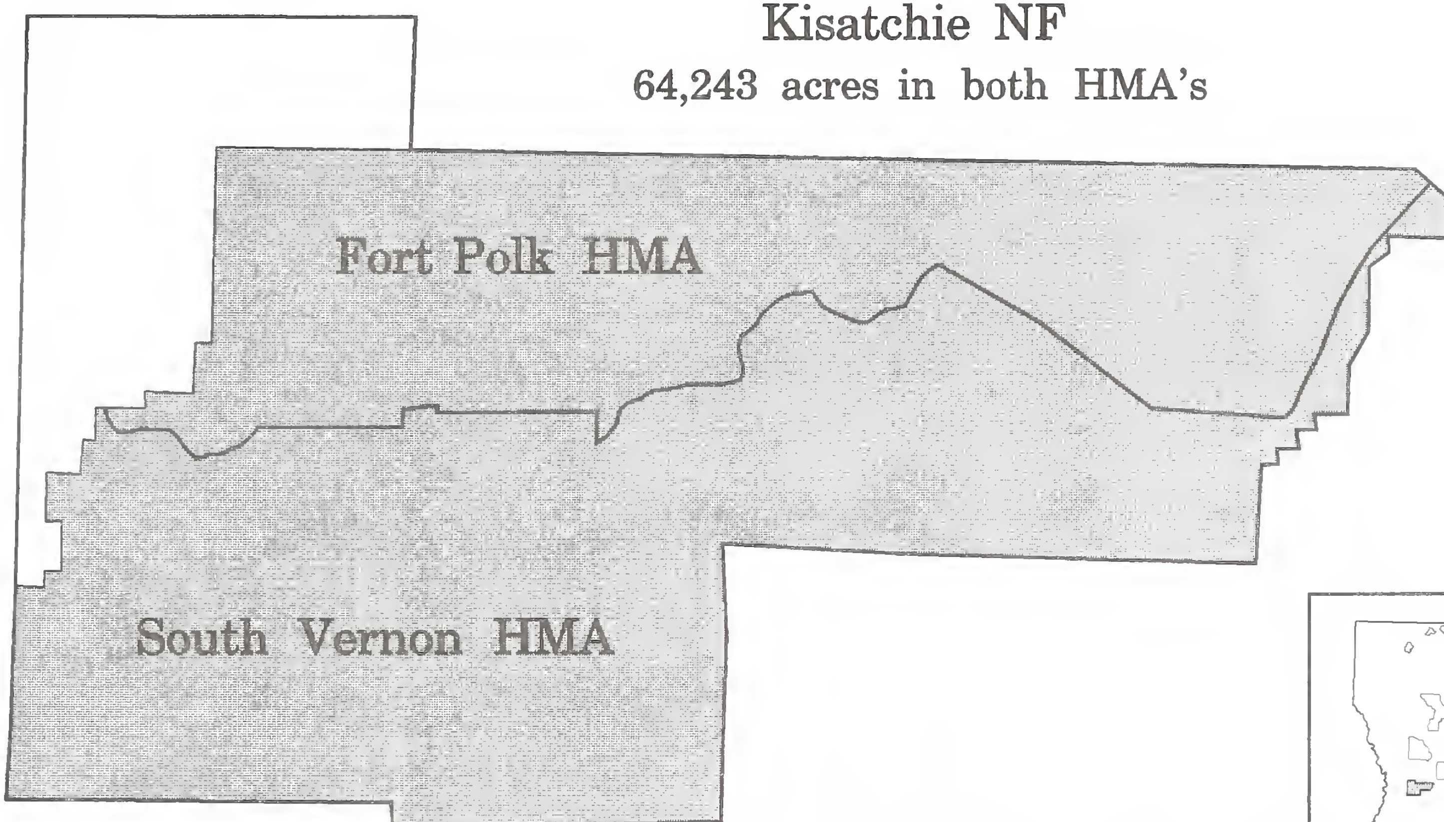
Red–Cockaded Woodpecker Habitat Management Areas

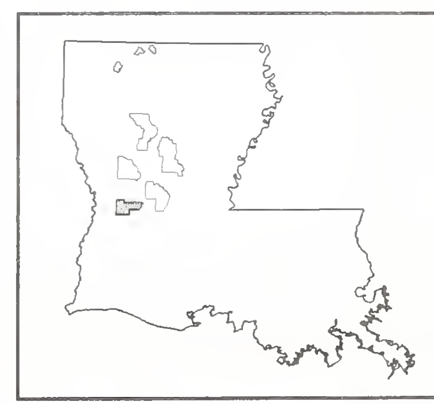




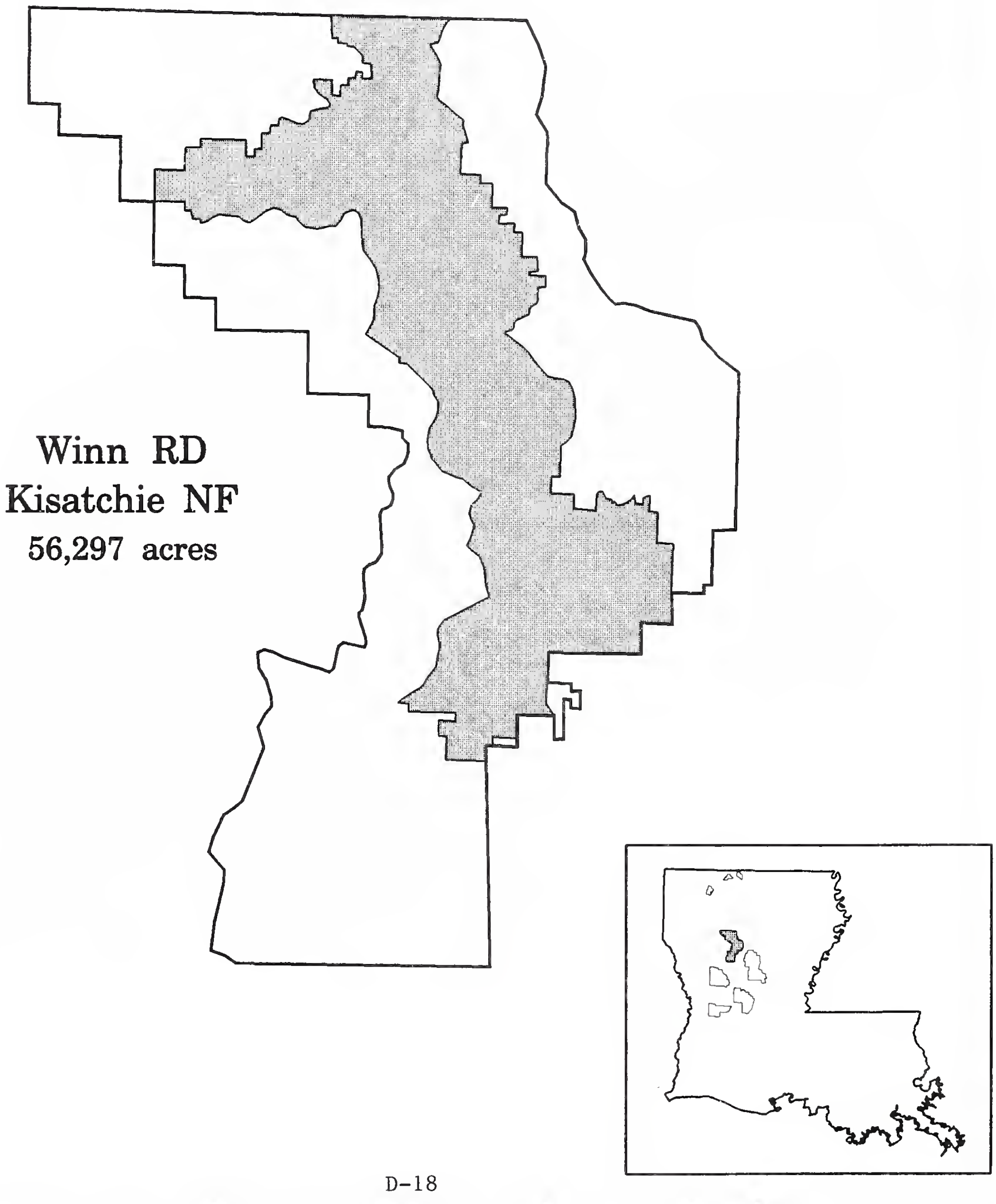
– Tentative –
Red–Cockaded Woodpecker Habitat Management Areas

Vernon RD
Kisatchie NF
64,243 acres in both HMA's

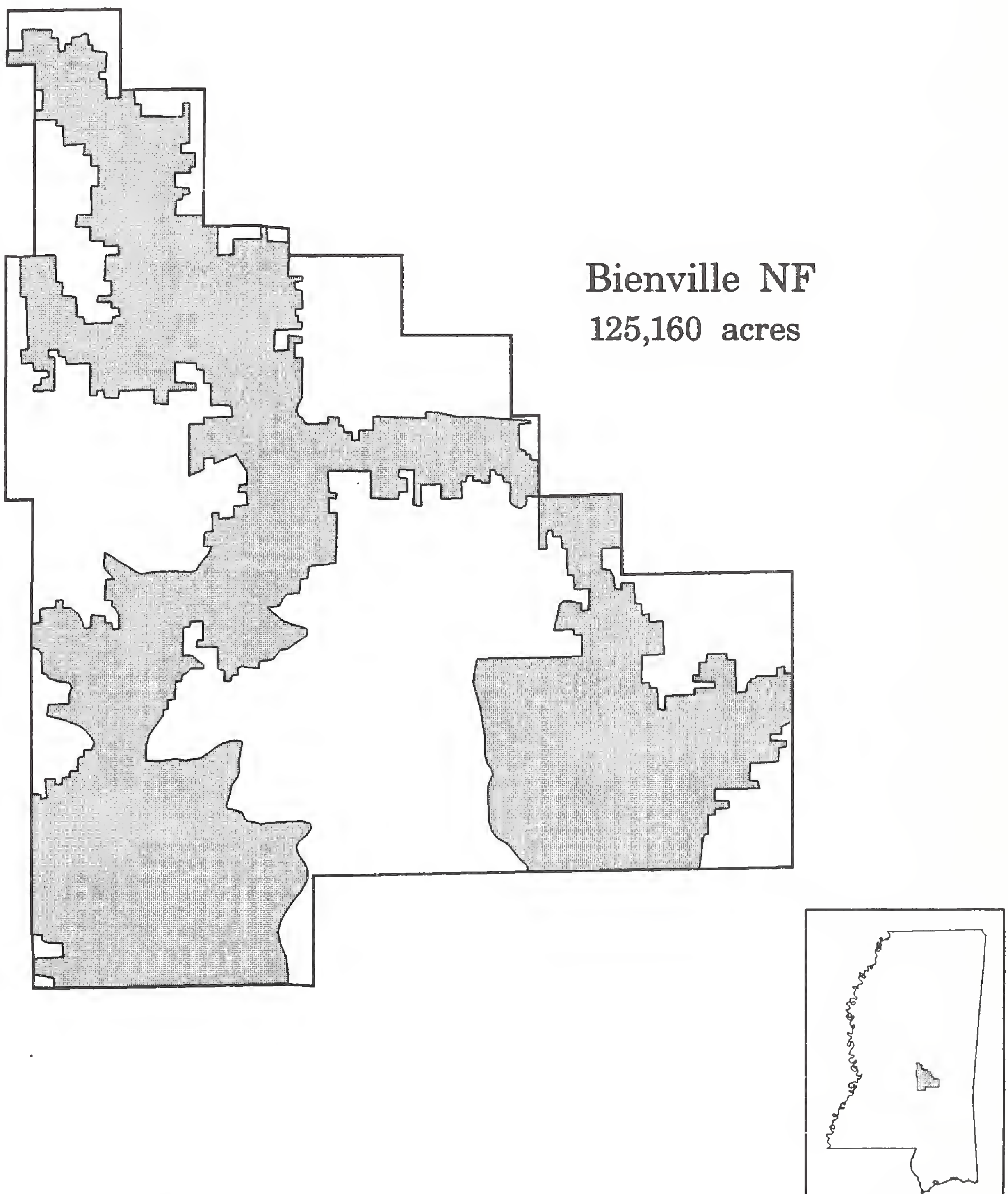




– Tentative –
Red–Cockaded Woodpecker Habitat Management Areas

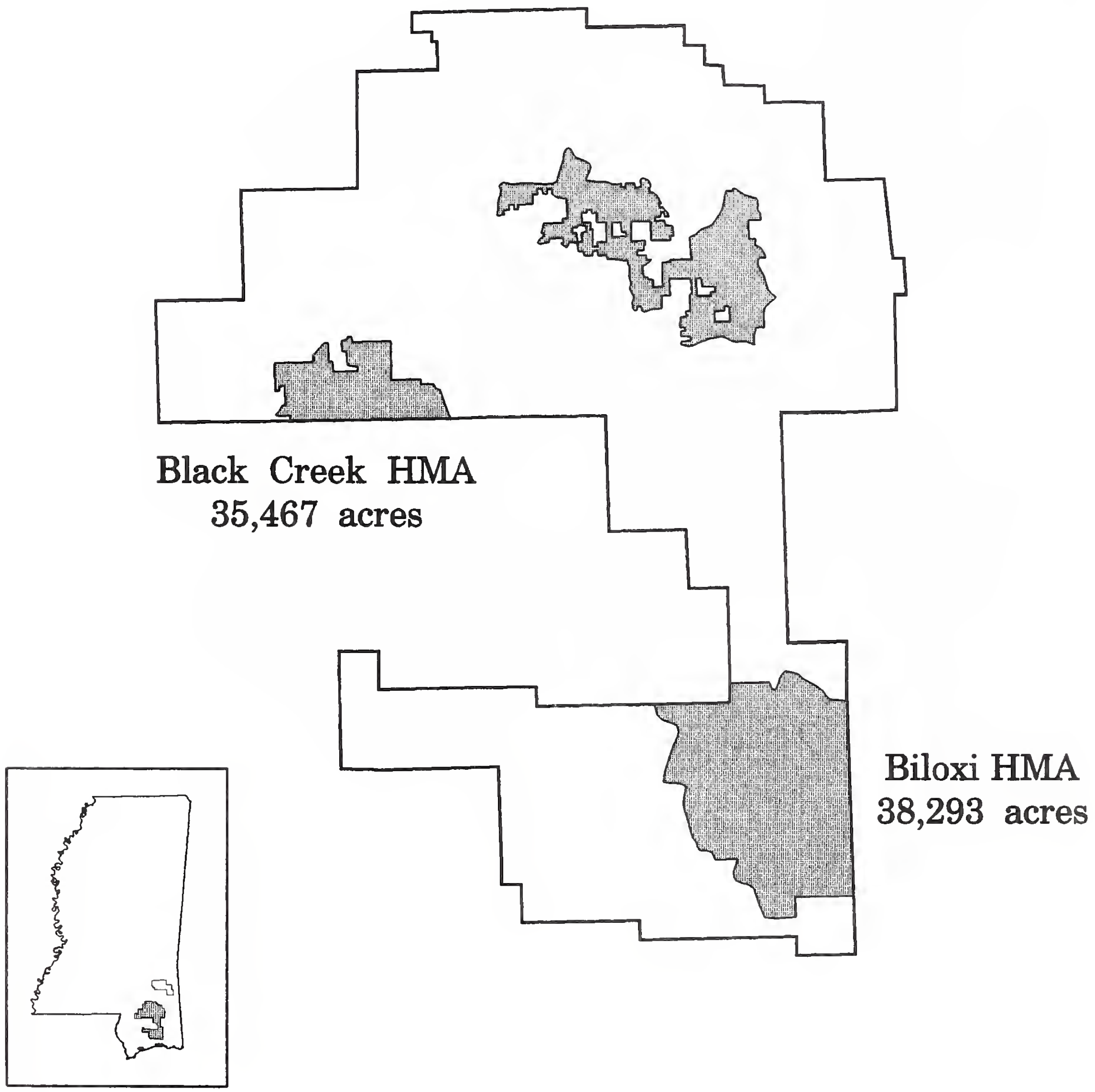


– Tentative –
Red–Cockaded Woodpecker Habitat Management Areas

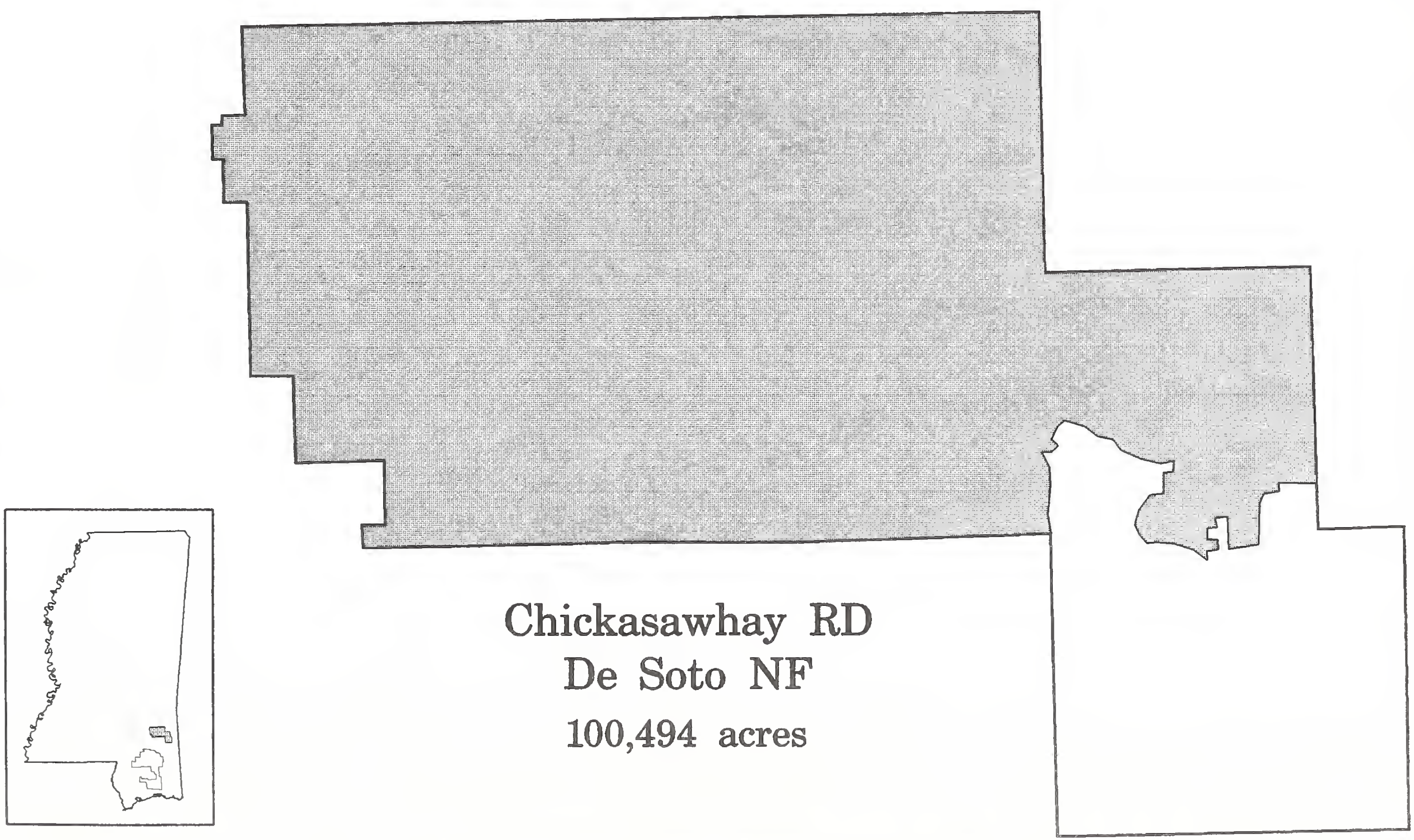


– Tentative –
Red–Cockaded Woodpecker Habitat Management Areas

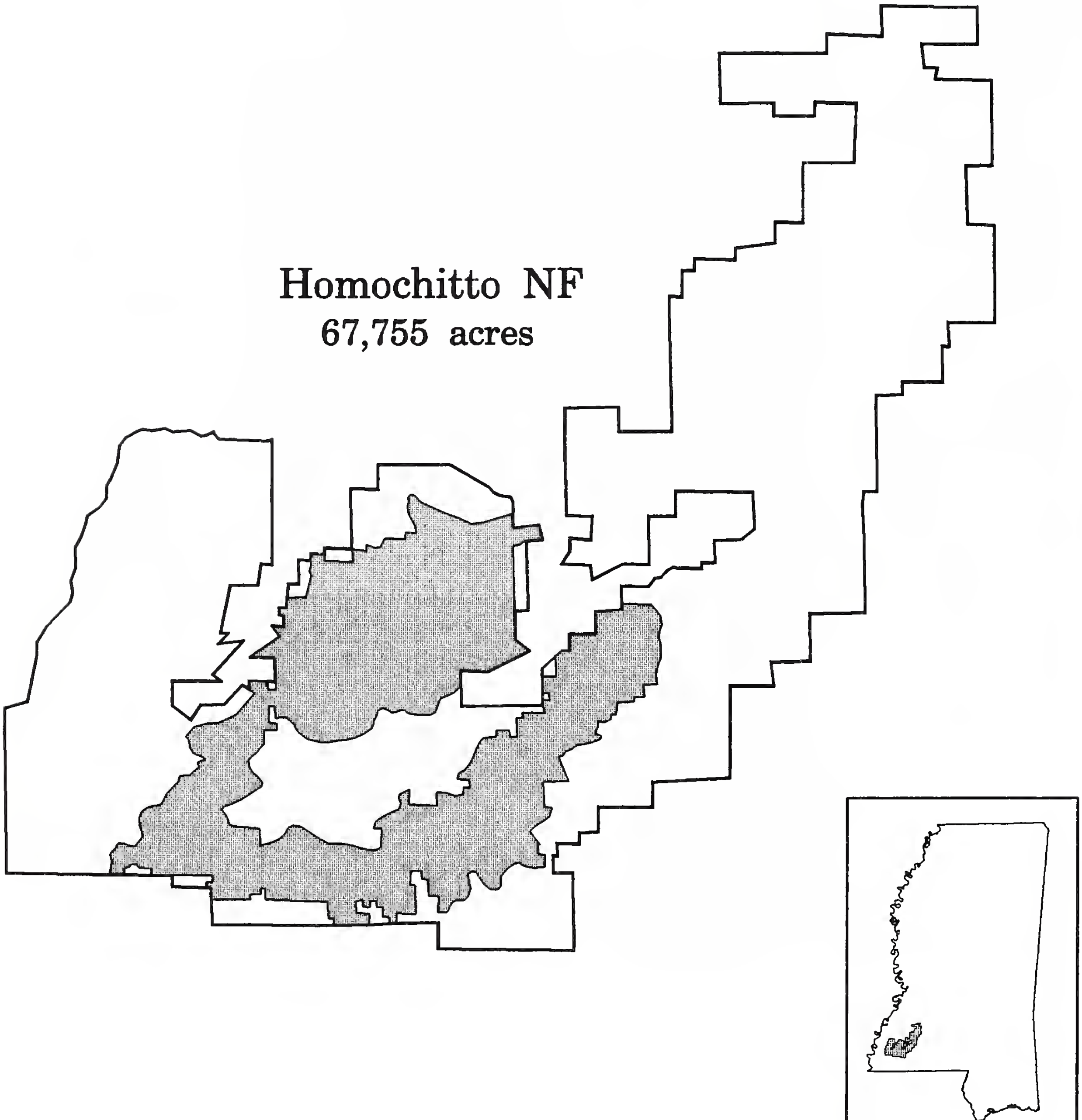
Black Creek and Biloxi RD's
De Soto NF



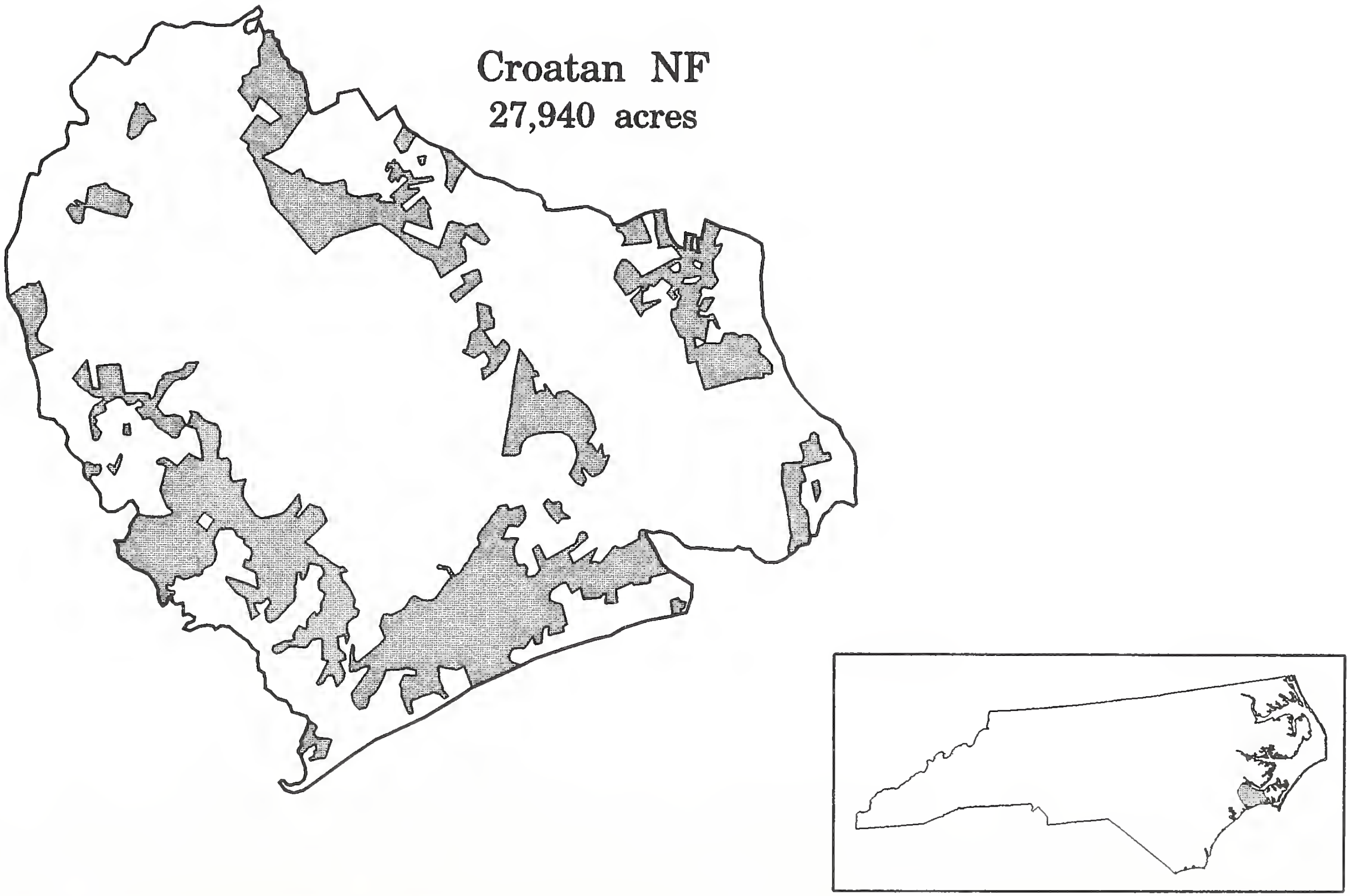
– Tentative –
Red–Cockaded Woodpecker Habitat Management Areas



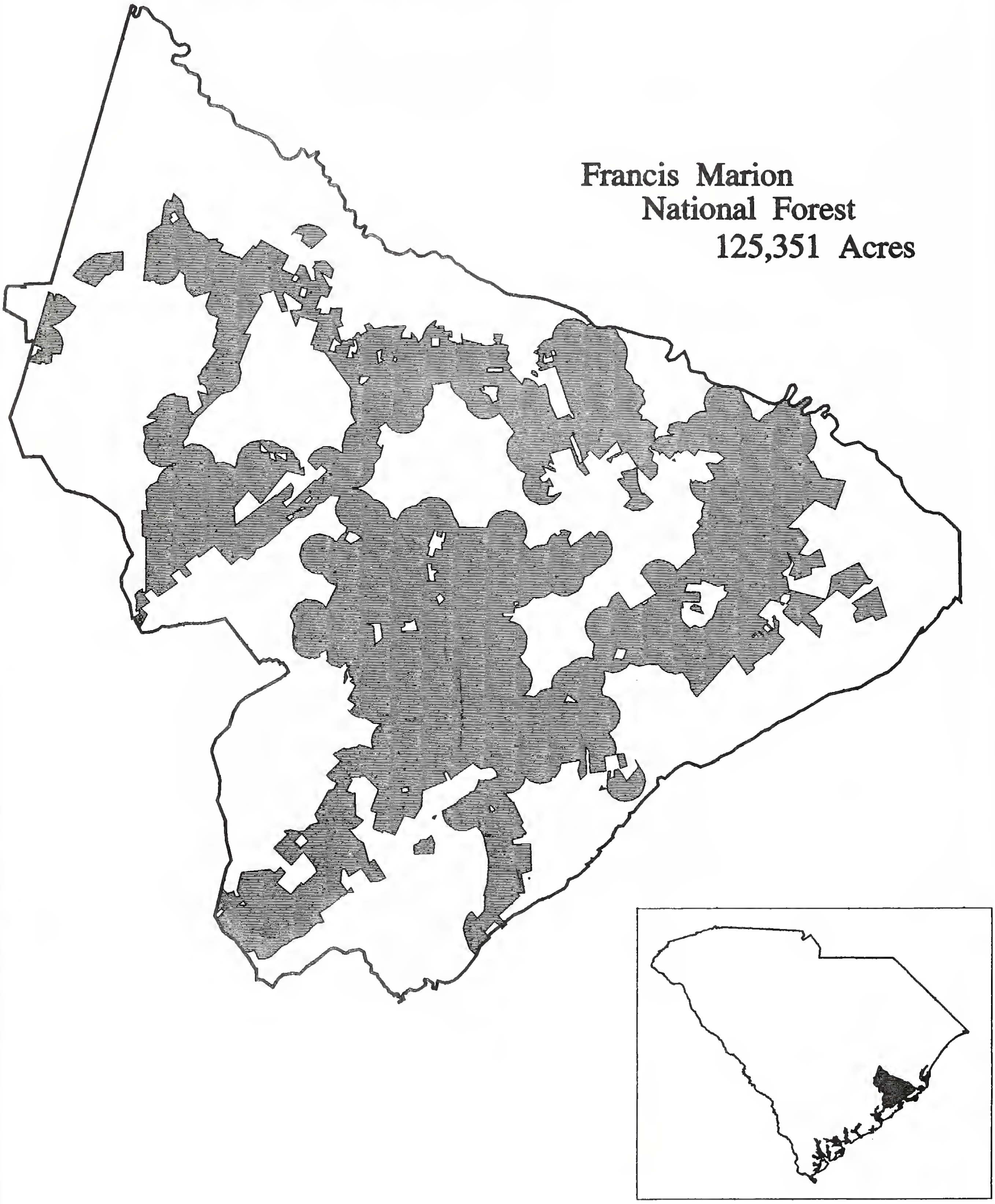
- Tentative -
Red-Cockaded Woodpecker Habitat Management Areas



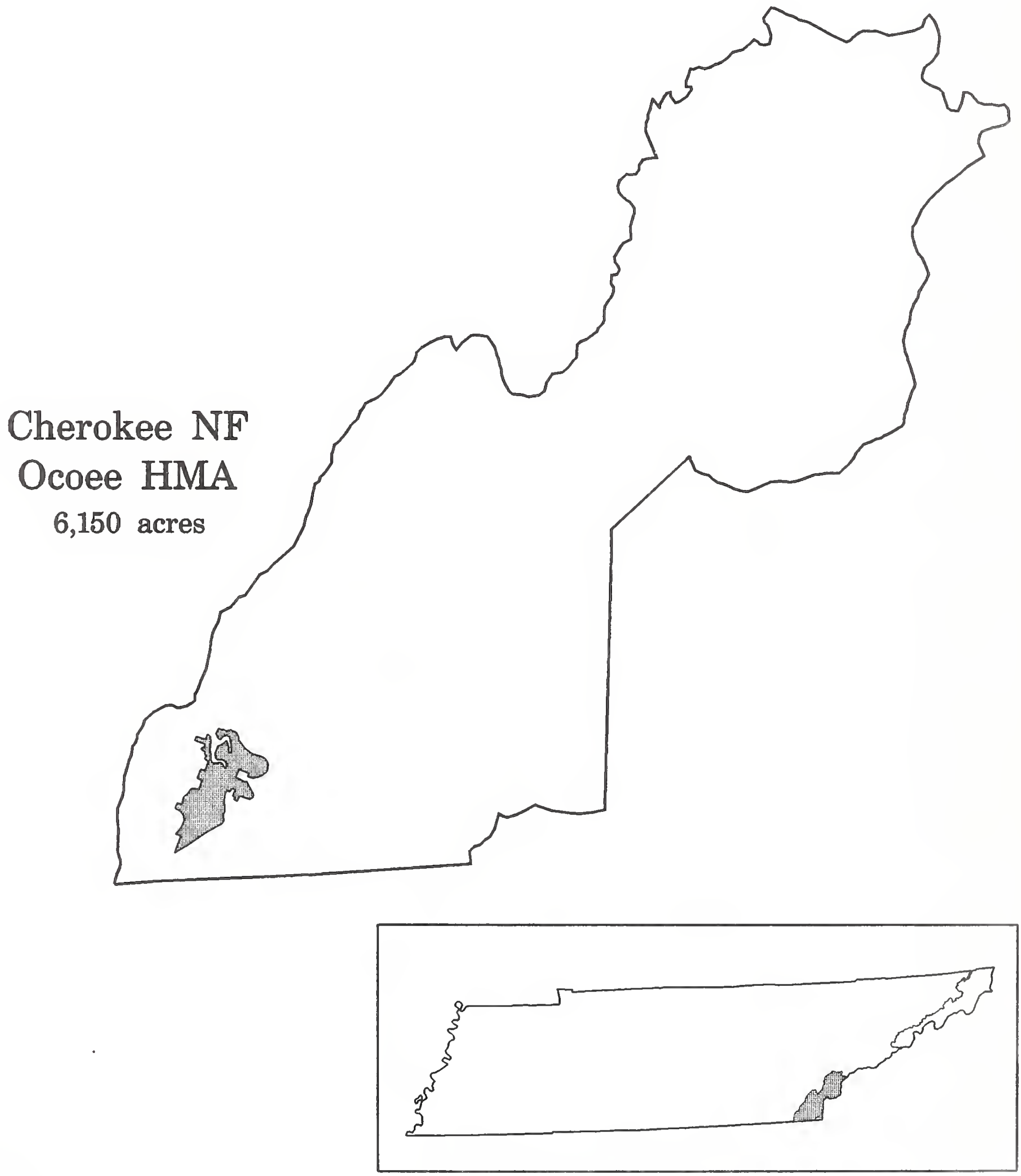
– Tentative –
Red–Cockaded Woodpecker Habitat Management Areas



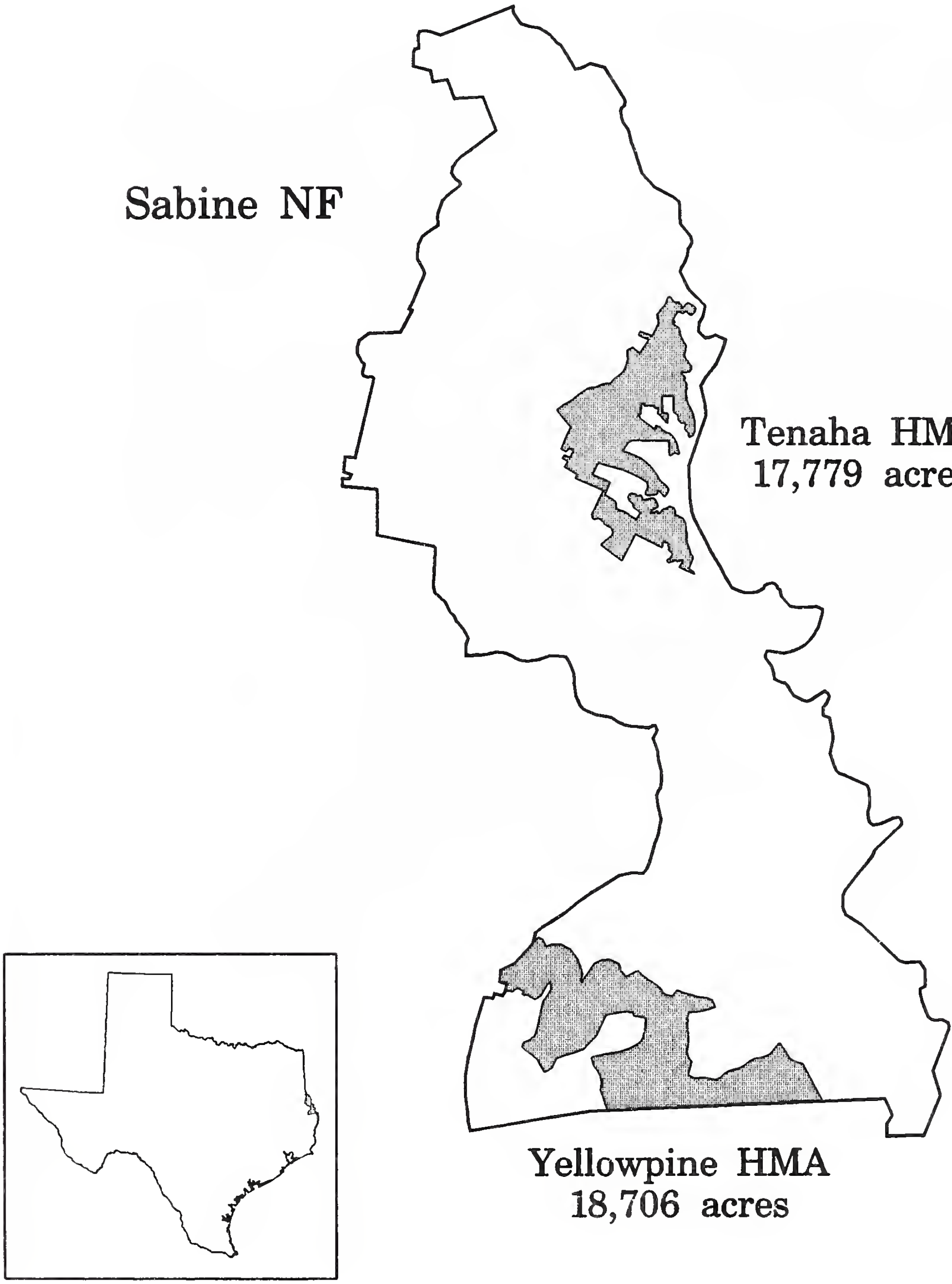
Tentative Red-Cockaded Woodpecker Habitat Management Areas



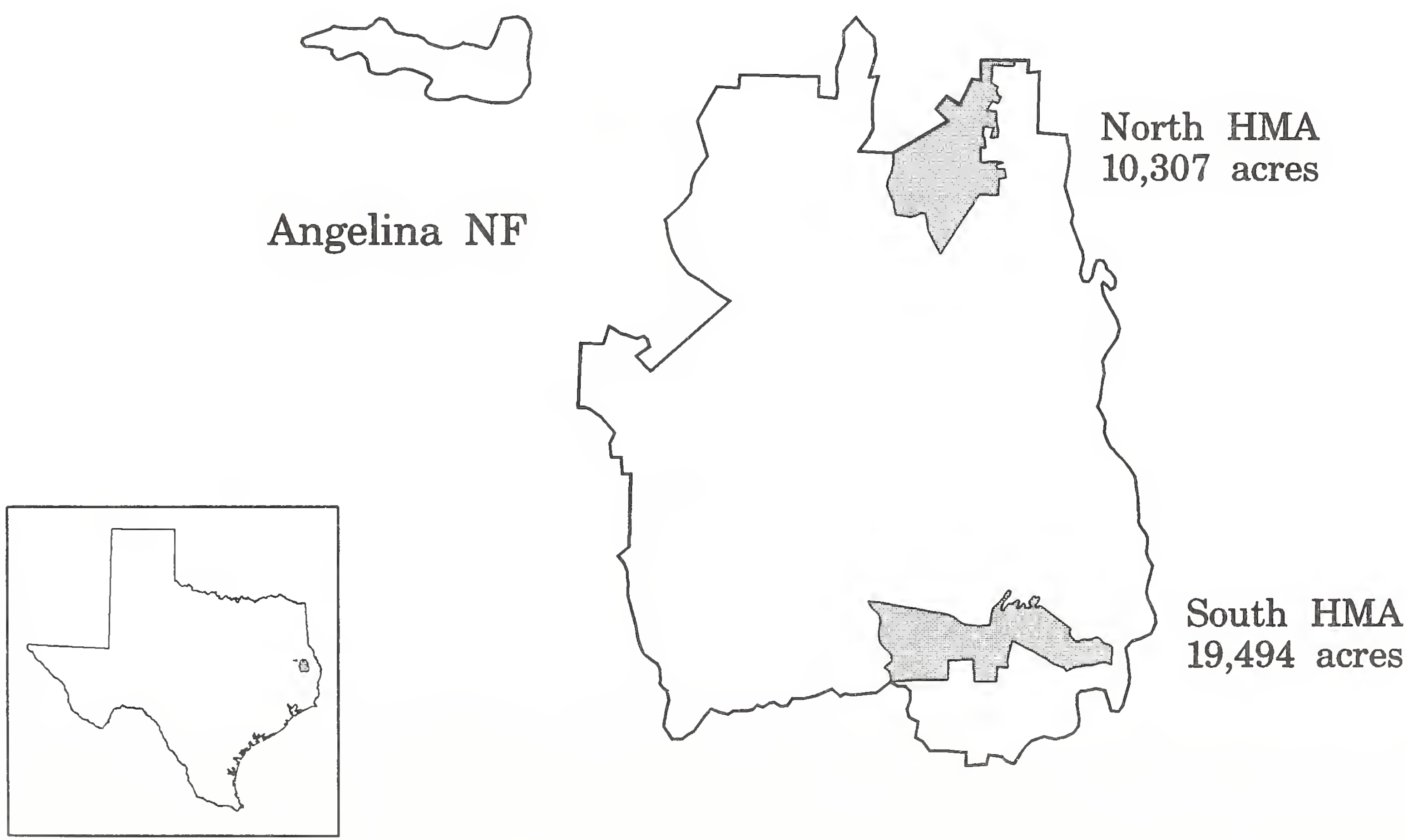
– Tentative –
Red–Cockaded Woodpecker Habitat Management Area



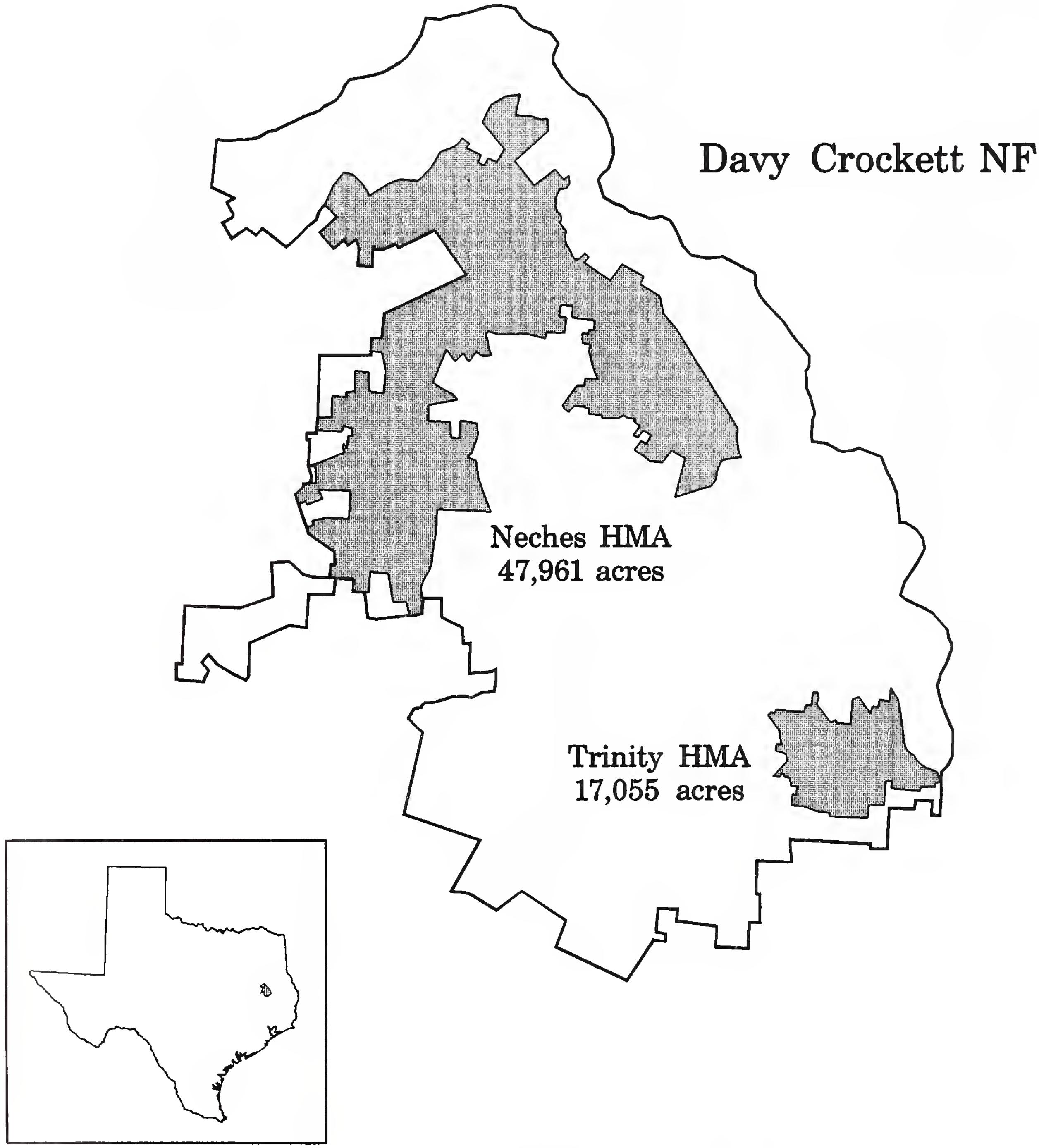
- Tentative -
Red–Cockaded Woodpecker Habitat Management Areas



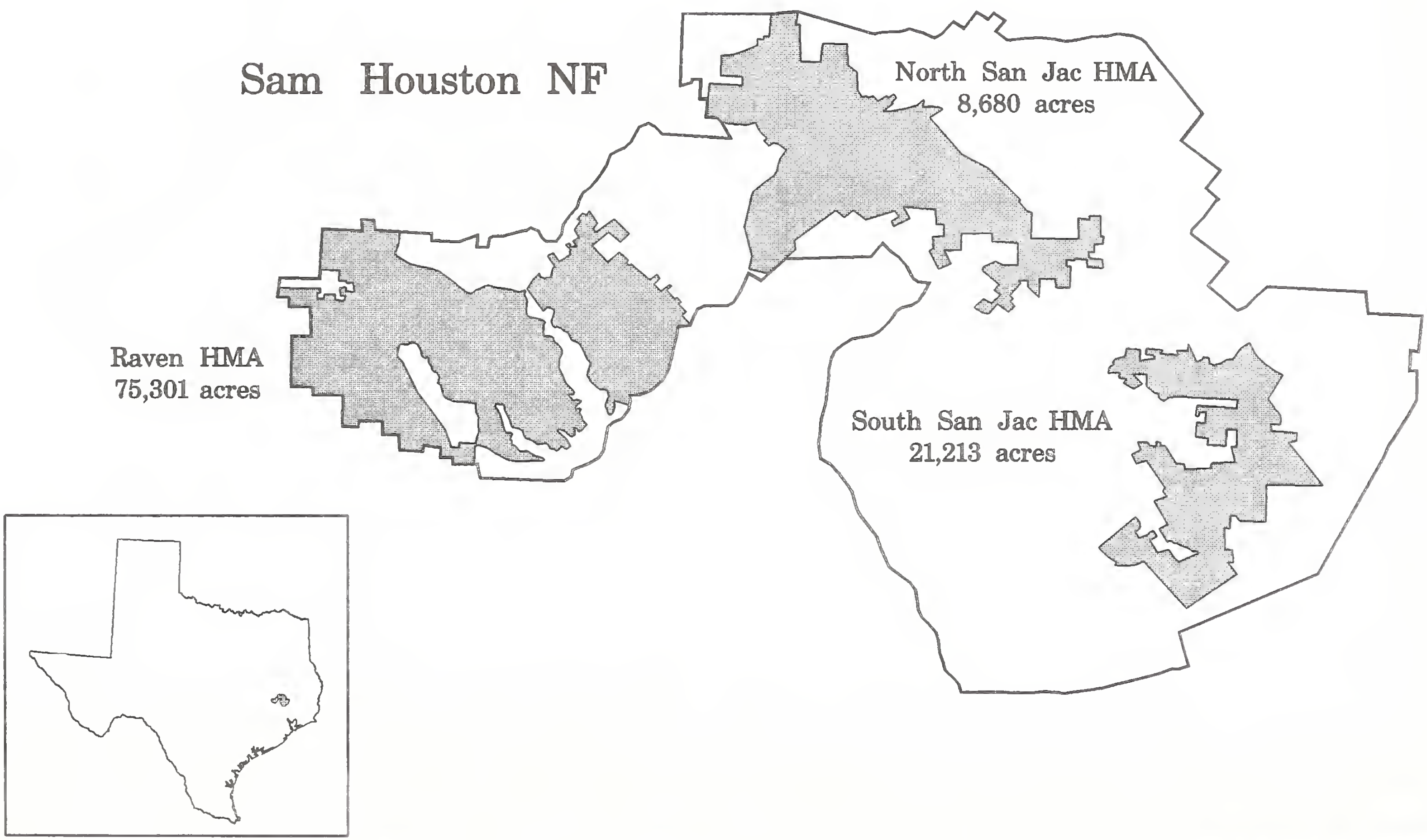
– Tentative –
Red–Cockaded Woodpecker Habitat Management Areas



– Tentative –
Red–Cockaded Woodpecker Habitat Management Areas



- Tentative -
Red-Cockaded Woodpecker Habitat Management Areas



APPENDIX E

Thinning Guides* for Yellow Pine in the Southern Region
(Longleaf, Slash, Shortleaf, Loblolly)

Total Height	Yellow Pine/Leave Basal Area
36-45	70
46-55	80
56-65	80
66-75	90
76-85	100
86-95	100
96-105	100
106-115	110
116-125	110
126-135	110

*These guides may be altered for local Forest site conditions.

FSH 2471.1
R-8 Silvicultural Handbook

APPENDIX F

ECONOMIC INFORMATION PRESENTED BY FOREST

During the comment period on the Draft Environmental Impact Statement, numerous comments were received suggesting it would be beneficial to display economic information by National Forest, rather than only for the region as a whole. The following tables are in response to these suggestions.

The Regional economic effects are disclosed in the economics section of Chapter 3. The following tables are based on that data and utilize regional averages. It is important to remember the values in the following table are derived from regional averages, and as such should be viewed only as a means of making relative comparisons between alternatives. They are not an accurate depiction of actual site specific local conditions. For example, the regional average for pine sawtimber was $265 per thousand board feet. Some forests had higher values for their pine sawtimber, while other forests had lower values. Forests whose pine sawtimber price was lower than the regional average would have inflated values presented in the table reflecting payments to states. Conversely, forests with pine sawtimber prices higher than the regional average would have lower values presented in the table of payments to states.

The timber volume projections are not commitments, but simply estimates for comparison purposes. These volume projections only take into account effects of RCW management. They do not consider any other factors that may affect available volume such as other forest plan standards and guidelines or budgets. Because of other constraints, actual volumes available may be less than those projected in the tables.

Again, it is important to remember these tables are only presented to allow for relative comparisons between alternatives. The economic analysis of local conditions will occur when individual forest plans are amended or revised.

Table F-1A
Estimated Harvest Levels by Alternative and Time Period.
Millions of Board Feet per Fiscal Year - NF's in Alabama

Time Period	Baseline* Volume	Alternatives A	B	C	D	E
Year 1-10						
Sawtimber	48.4	26.5	31.6	24.4	19.8	31.6
Pulpwood	34.8	25.7	27.5	24.5	19.3	27.5
	83.2	52.2	59.1	48.9	39.1	59.1
Year 11-20						
Sawtimber	48.4	28.2	36.6	28.2	20.6	36.6
Pulpwood	34.8	27.5	28.7	28.9	21.8	28.7
	83.2	55.7	65.3	56.6	42.4	65.3
Year 21-30						
Sawtimber	48.4	32.4	45.0	30.3	19.8	34.5
Pulpwood	34.8	25.1	33.3	29.6	16.9	26.3
	83.2	57.5	78.3	59.9	36.7	60.8

* Baseline volumes are based on the average volume of pine sawtimber and pulpwood harvested from 1987-89, prior to implementation of Interim S&Gs.

Table F-1B
Estimated Employment Levels Generated by National Forest Timber Harvest.
Jobs per Fiscal Year - NF's in Alabama

Time Period	Baseline Empl.*	Alternatives A	B	C	D	E
Year 1 - 10	790	490	560	460	370	560
Year 11 - 20	790	520	610	530	400	610
Year 21 - 30	790	550	740	560	350	570

* Baseline employment is based on the average employment generated by harvest of National Forest timber in 1988 - 89, prior to implementation of Interim.

Table F-1C
Estimated Income Levels Generated by National Forest Timber Harvest.
Millions of Dollars per Fiscal Year - NF's in Alabama

Time Period	Baseline Income*	Alternatives				
		A	B	C	D	E
Year 1 - 10	20	13	14	12	9	14
Year 11 - 20	20	13	16	14	10	16
Year 21 - 30	20	14	19	14	9	15

* Baseline income is based on the average income generated by harvest of National Forest timber in 1988-89, prior to implementation of Interim.

Table F-1D
Estimated Payments to States Generated by National Forest Timber Harvest.
Millions of Dollars per Fiscal Year - NF's in Alabama

Time Period	Baseline* Payments	Alternatives				
		A	B	C	D	E
Year 1 - 10	3.5	2.0	2.3	1.8	1.5	2.3
Year 11 - 20	3.5	2.0	2.8	2.0	1.5	2.8
Year 21 - 30	3.5	2.3	3.3	2.3	1.5	2.5

* Baseline payments to states are based on the average payments generated by harvest of National Forest timber in 1987-89, prior to implementation of Interim. Baseline rates are presented in 1994 values.

Table F-2A
Estimated Harvest Levels by Alternative and Time Period.
Millions of Board Feet per Fiscal Year - Ouachita NF

Time Period	Baseline* Volume	A	B	C	D	E
Year 1-10						
Sawtimber	100.9	97.2	98.0	96.8	96.1	96.8
Pulpwood	71.2	69.7	70.0	69.5	68.6	69.6
	172.1	166.9	168.0	166.3	164.7	166.4
Year 11-20						
Sawtimber	100.9	97.5	98.9	97.5	96.2	97.3
Pulpwood	71.2	70.0	70.0	70.1	69.0	69.9
	172.1	167.5	168.9	167.6	165.2	167.2
Year 21-30						
Sawtimber	100.9	98.2	100.3	97.8	96.1	98.5
Pulpwood	71.2	69.6	70.9	70.3	68.2	69.8
	172.1	167.8	171.2	168.1	164.3	168.3

* Baseline volumes are based on the average volume of pine sawtimber and pulpwood harvested from 1987-89, prior to implementation of Interim S&Gs.

Table F-2B
Estimated Employment Levels Generated by National Forest Timber Harvest.
Jobs per Fiscal Year - Ouachita NF

Time Period	Baseline Empl.*	Alternatives A	B	C	D	E
Year 1 - 10	1640	1560	1590	1560	1560	1560
Year 11 - 20	1640	1580	1600	1580	1560	1570
Year 21 - 30	1640	1580	1610	1580	1540	1580

* Baseline employment is based on the average employment generated by harvest of National Forest timber in 1988 - 89, prior to implementation of Interim.

Table F-2C
Estimated Income Levels Generated by National Forest Timber Harvest. Millions of Dollars per Fiscal Year - Ouachita NF

Time Period	Baseline Income*	Alternatives				
		A	B	C	D	E
Year 1 - 10	41	40	40	40	40	40
Year 11 - 20	41	40	41	40	40	40
Year 21 - 30	41	40	41	40	39	40

* Baseline income is based on the average income generated by harvest of National Forest timber in 1988-89, prior to implementation of Interim.

Table F-2D
Estimated Payments to States Generated by National Forest Timber Harvest. Millions of Dollars per Fiscal Year - Ouachita NF

Time Period	Baseline* Payments	Alternatives				
		A	B	C	D	E
Year 1 - 10	7.3	7.0	7.1	7.0	6.9	7.0
Year 11 - 20	7.3	7.0	7.1	7.0	6.9	7.0
Year 21 - 30	7.3	7.1	7.2	7.1	6.9	7.1

* Baseline payments to states are based on the average payments generated by harvest of National Forest timber in 1987-89, prior to implementation of Interim. Baseline rates are presented in 1994 values.

Table F-3A
Estimated Harvest Levels by Alternative and Time Period.
Millions of Board Feet per Fiscal Year - NF's in Florida

Time Period	Baseline* Volume	Alternatives A	B	C	D	E
Year 1-10						
Sawtimber	20.4	00.0	01.1	00.0	00.0	00.0
Pulpwood	82.8	54.9	56.6	54.9	34.0	56.6
	103.2	54.9	57.6	54.9	34.0	56.6
Year 11-20						
Sawtimber	20.4	00.0	02.9	00.2	00.0	00.2
Pulpwood	82.8	47.8	51.9	47.8	35.4	51.9
	103.2	47.8	54.8	48.0	35.4	52.1
Year 21-30						
Sawtimber	20.4	06.3	16.1	05.9	00.2	11.8
Pulpwood	82.8	49.1	61.5	48.5	23.0	56.7
	103.2	55.4	77.6	54.4	23.2	68.5

* Baseline volumes are based on the average volume of pine sawtimber and pulpwood harvested from 1987-89, prior to implementation of Interim S&Gs.

Table F-3B
Estimated Employment Levels Generated by National Forest Timber Harvest.
Jobs per Fiscal Year - NF's in Florida

Time Period	Baseline Empl.*	Alternatives A	B	C	D	E
Year 1 - 10	970	520	540	520	320	530
Year 11 - 20	970	450	520	450	330	490
Year 21 - 30	970	520	730	510	220	640

* Baseline employment is based on the average employment generated by harvest of National Forest timber in 1988 - 89, prior to implementation of Interim.

Table F-3C
Estimated Income Levels Generated by National Forest Timber Harvest.
Millions of Dollars per Fiscal Year - NF's in Florida

Time Period	Baseline Income*	Alternatives				
		A	B	C	D	E
Year 1 - 10	25	13	14	13	8	14
Year 11 - 20	25	11	13	13	9	13
Year 21 - 30	25	13	19	13	6	16

* Baseline income is based on the average income generated by harvest of National Forest timber in 1988-89, prior to implementation of Interim.

Table F-3D
Estimated Payments to States Generated by National Forest Timber Harvest.
Millions of Dollars per Fiscal Year - NF's in Florida

Time Period	Baseline* Payments	Alternatives				
		A	B	C	D	E
Year 1 - 10	2.0	0.5	0.5	0.5	0.3	0.5
Year 11 - 20	2.0	0.4	0.6	0.4	0.3	0.5
Year 21 - 30	2.0	0.8	1.6	0.8	0.2	1.2

* Baseline payments to states are based on the average payments generated by harvest of National Forest timber in 1987-89, prior to implementation of Interim. Baseline rates are presented in 1994 values.

Table F-4A
**Estimated Harvest Levels by Alternative and Time Period.
Millions of Board Feet per Fiscal Year - Chattahoochee-Oconee NF**

Time Period	Baseline* Volume	A	B	Alternatives C	D	E
Year 1-10						
Sawtimber	35.8	31.2	32.3	30.8	29.8	30.8
Pulpwood	22.1	20.5	20.9	20.3	19.4	20.4
	57.9	51.7	53.2	51.1	49.2	51.2
Year 11-20						
Sawtimber	35.8	31.6	33.4	31.6	30.0	31.3
Pulpwood	22.1	20.9	20.9	21.1	19.8	20.8
	57.9	52.5	54.3	52.7	49.8	52.1
Year 21-30						
Sawtimber	35.8	32.5	35.2	32.0	29.8	32.9
Pulpwood	22.1	20.4	21.9	21.2	18.9	20.6
	57.9	52.9	57.1	53.2	48.7	53.5

* Baseline volumes are based on the average volume of pine sawtimber and pulpwood harvested from 1987-89, prior to implementation of Interim S&Gs.

Table F-4B
**Estimated Employment Levels Generated by National Forest Timber Harvest.
Jobs per Fiscal Year - Chattahoochee-Oconee NF**

Time Period	Baseline Empl.*	Alternatives				
		A	B	C	D	E
Year 1 - 10	540	490	500	480	460	480
Year 11 - 20	540	490	510	500	470	490
Year 21 - 30	540	500	540	500	460	500

* Baseline employment is based on the average employment generated by harvest of National Forest timber in 1988 - 89, prior to implementation of Interim.

Table F-4C
Estimated Income Levels Generated by National Forest Timber Harvest.
Millions of Dollars per Fiscal Year - Chattahoochee-Oconee NF

Time Period	Baseline Income*	Alternatives				
		A	B	C	D	E
Year 1 - 10	14	12	13	12	12	12
Year 11 - 20	14	13	13	13	12	13
Year 21 - 30	14	13	14	13	12	13

* Baseline income is based on the average income generated by harvest of National Forest timber in 1988-89, prior to implementation of Interim.

Table F-4D
Estimated Payments to States Generated by National Forest Timber Harvest.
Millions of Dollars per Fiscal Year - Chattahoochee-Oconee NF

Time Period	Baseline* Payments	Alternatives				
		A	B	C	D	E
Year 1 - 10	2.6	2.2	2.3	2.2	2.1	2.2
Year 11 - 20	2.6	2.3	2.4	2.3	2.2	2.2
Year 21 - 30	2.6	2.3	2.5	2.3	2.1	2.3

* Baseline payments to states are based on the average payments generated by harvest of National Forest timber in 1987-89, prior to implementation of Interim. Baseline rates are presented in 1994 values.

Table F-5A
Estimated Harvest Levels by Alternative and Time Period.
Millions of Board Feet per Fiscal Year - Daniel Boone NF

Time Period	Baseline* Volume	Alternatives A	B	C	D	E
Year 1-10						
Sawtimber	9.2	5.1	5.3	5.0	4.9	5.0
Pulpwood	3.3	5.0	5.0	4.8	4.7	5.0
	12.5	10.1	10.3	9.8	9.6	10.0
Year 11-20						
Sawtimber	9.2	8.0	8.4	8.0	7.7	8.0
Pulpwood	3.3	8.0	8.0	8.0	7.7	8.0
	12.5	16.0	16.4	16.0	15.4	16.0
Year 21-30						
Sawtimber	9.2	9.9	10.6	9.8	9.2	10.0
Pulpwood	3.3	9.9	10.5	10.5	9.5	10.2
	12.5	19.8	21.1	20.3	18.7	20.2

* Baseline volumes are based on the average volume of pine sawtimber and pulpwood harvested from 1987-89, prior to implementation of Interim S&Gs.

Table F-5B
Estimated Employment Levels Generated by National Forest Timber Harvest.
Jobs per Fiscal Year - Daniel Boone NF

Time Period	Baseline Empl.*	Alternatives A	B	C	D	E
Year 1 - 10	120	100	100	90	90	90
Year 11 - 20	120	150	150	150	150	150
Year 21 - 30	120	190	200	190	180	190

* Baseline employment is based on the average employment generated by harvest of National Forest timber in 1988 - 89, prior to implementation of Interim.

Table F-5C
Estimated Income Levels Generated by National Forest Timber Harvest. Millions of Dollars per Fiscal Year - Daniel Boone NF

Time Period	Baseline Income*	Alternatives				
		A	B	C	D	E
Year 1 - 10	3	2	2	2	2	2
Year 11 - 20	3	4	4	4	4	4
Year 21 - 30	3	5	5	5	4	5

* Baseline income is based on the average income generated by harvest of National Forest timber in 1988-89, prior to implementation of Interim.

Table F-5D
Estimated Payments to States Generated by National Forest Timber Harvest. Millions of Dollars per Fiscal Year - Daniel Boone NF

Time Period	Baseline* Payments	Alternatives				
		A	B	C	D	E
Year 1 - 10	0.6	0.4	0.4	0.4	0.4	0.4
Year 11 - 20	0.6	0.6	0.6	0.6	0.6	0.6
Year 21 - 30	0.6	0.7	0.8	0.7	0.7	0.7

* Baseline payments to states are based on the average payments generated by harvest of National Forest timber in 1987-89, prior to implementation of Interim. Baseline rates are presented in 1994 values.

Table F-6A
Estimated Harvest Levels by Alternative and Time Period.
Millions of Board Feet per Fiscal Year - Kisatchie NF

Time Period	Baseline* Volume	Alternatives A	B	C	D	E
Year 1-10						
Sawtimber	74.0	46.7	53.0	44.1	38.3	53.0
Pulpwood	56.8	44.7	47.1	43.1	35.9	47.1
	130.8	91.4	100.1	87.2	74.2	100.1
Year 11-20						
Sawtimber	74.0	48.8	59.3	48.8	39.4	59.3
Pulpwood	56.8	47.1	52.6	48.4	39.5	52.6
	130.8	95.9	111.9	97.2	78.9	111.9
Year 21-30						
Sawtimber	74.0	54.1	69.8	51.4	38.3	56.7
Pulpwood	56.8	43.9	54.8	50.0	33.0	45.5
	130.8	98.0	124.6	101.4	71.3	102.2

* Baseline volumes are based on the average volume of pine sawtimber and pulpwood harvested from 1987-89, prior to implementation of Interim S&Gs.

Table F-6B
Estimated Employment Levels Generated by National Forest Timber Harvest.
Jobs per Fiscal Year - Kisatchie NF

Time Period	Baseline Empl.*	Alternatives A	B	C	D	E
Year 1 - 16	1230	860	940	820	700	940
Year 11 - 20	1230	900	1050	910	740	1050
Year 21 - 30	1230	920	1170	950	670	960

* Baseline employment is based on the average employment generated by harvest of National Forest timber in 1988 - 89, prior to implementation of Interim.

Table F-6C
Estimated Income Levels Generated by National Forest Timber Harvest.
Millions of Dollars per Fiscal Year - Kisatchie NF

Time Period	Baseline Income*	Alternatives				
		A	B	C	D	E
Year 1 - 10	31	22	24	21	18	24
Year 11 - 20	31	23	27	23	19	27
Year 21 - 30	31	24	30	24	17	25

* Baseline income is based on the average income generated by harvest of National Forest timber in 1988-89, prior to implementation of Interim.

Table F-6D
Estimated Payments to States Generated by National Forest Timber Harvest.
Millions of Dollars per Fiscal Year - Kisatchie NF

Time Period	Baseline* Payments	Alternatives				
		A	B	C	D	E
Year 1 - 10	5.4	3.5	3.9	3.3	2.8	3.9
Year 11 - 20	5.4	3.6	4.4	3.6	2.9	4.4
Year 21 - 30	5.4	3.9	5.1	3.8	2.8	4.1

* Baseline payments to states are based on the average payments generated by harvest of National Forest timber in 1987-89, prior to implementation of Interim. Baseline rates are presented in 1994 values.

Table F-7A
Estimated Harvest Levels by Alternative and Time Period.
Millions of Board Feet per Fiscal Year - NF's in Mississippi

Time Period	Baseline* Volume	Alternatives A	B	C	D	E
Year 1-10						
Sawtimber	126.1	99.2	105.4	64.6	60.8	105.4
Pulpwood	83.7	73.4	75.5	78.0	71.8	75.5
	209.8	172.6	180.9	142.6	132.6	180.9
Year 11-20						
Sawtimber	126.1	101.3	111.6	81.3	73.8	111.6
Pulpwood	83.7	75.5	75.8	81.5	73.5	75.8
	209.8	176.8	187.4	162.8	147.3	187.4
Year 21-30						
Sawtimber	126.1	106.5	122.0	81.0	70.9	85.0
Pulpwood	83.7	72.7	82.0	89.3	72.8	85.0
	209.8	179.2	204.0	170.3	143.7	170.0

* Baseline volumes are based on the average volume of pine sawtimber and pulpwood harvested from 1987-89, prior to implementation of Interim S&Gs.

Table F-7B
Estimated Employment Levels Generated by National Forest Timber Harvest.
Jobs per Fiscal Year - NF's in Mississippi

Time Period	Baseline Empl.*	Alternatives A	B	C	D	E
Year 1 - 10	1970	1620	1700	1340	1250	1700
Year 11 - 20	1970	1660	1760	1530	1390	1760
Year 21 - 30	1970	1680	1920	1600	1350	1600

* Baseline employment is based on the average employment generated by harvest of National Forest timber in 1988 - 89, prior to implementation of Interim.

Table F-7C
Estimated Income Levels Generated by National Forest Timber Harvest.
Millions of Dollars per Fiscal Year - NF's in Mississippi

Time Period	Baseline Income*	Alternatives				
		A	B	C	D	E
Year 1 - 10	50	41	43	34	32	43
Year 11 - 20	50	42	45	39	35	45
Year 21 - 30	50	43	49	41	34	41

* Baseline income is based on the average income generated by harvest of National Forest timber in 1988-89, prior to implementation of Interim.

Table F-7D
Estimated Payments to States Generated by National Forest Timber Harvest.
Millions of Dollars per Fiscal Year - NF's in Mississippi

Time Period	Baseline* Payments	Alternatives				
		A	B	C	D	E
Year 1 - 10	9.0	7.2	7.6	4.9	4.6	7.6
Year 11 - 20	9.0	7.3	8.0	6.1	5.5	8.0
Year 21 - 30	9.0	7.7	8.8	6.1	5.3	6.3

* Baseline payments to states are based on the average payments generated by harvest of National Forest timber in 1987-89, prior to implementation of Interim. Baseline rates are presented in 1994 values.

Table F-8A
Estimated Harvest Levels by Alternative and Time Period.
Millions of Board Feet per Fiscal Year - NF's in North Carolina

Time Period	Baseline* Volume	Alternatives A	B	C	D	E
Year 1-10						
Sawtimber	11.3	9.1	9.6	8.9	8.4	8.9
Pulpwood	9.3	8.3	8.4	8.1	7.6	8.2
	20.6	17.4	18.0	17.0	16.0	17.1
Year 11-20						
Sawtimber	11.3	9.3	10.1	9.3	8.5	9.1
Pulpwood	9.3	8.5	8.5	8.6	7.8	8.4
	20.6	17.8	18.6	17.9	16.3	17.5
Year 21-30						
Sawtimber	11.3	9.7	11.0	9.5	8.4	9.9
Pulpwood	9.3	8.2	9.1	8.7	7.2	8.3
	20.6	17.9	20.1	18.2	15.6	18.2

* Baseline volumes are based on the average volume of pine sawtimber and pulpwood harvested from 1987-89, prior to implementation of Interim S&Gs.

Table F-8B
Estimated Employment Levels Generated by National Forest Timber Harvest.
Jobs per Fiscal Year - NF's in North Carolina

Time Period	Baseline Empl.*	Alternatives A	B	C	D	E
Year 1 - 10	190	160	170	160	150	160
Year 11 - 20	190	170	170	170	150	170
Year 21 - 30	190	170	190	170	150	170

* Baseline employment is based on the average employment generated by harvest of National Forest timber in 1988 - 89, prior to implementation of Interim.

Table F-8C
Estimated Income Levels Generated by National Forest Timber Harvest.
Millions of Dollars per Fiscal Year - NF's in North Carolina

Time Period	Baseline Income*	Alternatives				
		A	B	C	D	E
Year 1 - 10	5	4	4	4	4	4
Year 11 - 20	5	4	4	4	4	4
Year 21 - 30	5	4	5	4	4	4

* Baseline income is based on the average income generated by harvest of National Forest timber in 1988-89, prior to implementation of Interim.

Table F-8D
Estimated Payments to States Generated by National Forest Timber Harvest.
Millions of Dollars per Fiscal Year - NF's in North Carolina

Time Period	Baseline* Payments	Alternatives				
		A	B	C	D	E
Year 1 - 10	0.8	0.7	0.7	0.7	0.6	0.7
Year 11 - 20	0.8	0.7	0.7	0.7	0.6	0.7
Year 21 - 30	0.8	0.7	0.8	0.7	0.6	0.7

* Baseline payments to states are based on the average payments generated by harvest of National Forest timber in 1987-89, prior to implementation of Interim. Baseline rates are presented in 1994 values.

Table F-9A
**Estimated Harvest Levels by Alternative and Time Period.
Millions of Board Feet per Fiscal Year - Francis Marion NF**

Time Period	Baseline* Volume	Alternatives A	B	C	D	E
Year 1-10						
Sawtimber	7.4	6.9	7.4	6.7	6.3	6.7
Pulpwood	10.5	10.2	10.5	10.0	9.1	10.1
	17.9	17.1	17.9	16.7	15.4	16.8
Year 11-20						
Sawtimber	7.4	0.2	0.2	0.2	0.2	0.2
Pulpwood	10.5	11.6	11.6	11.7	10.5	11.5
	17.9	11.8	11.8	11.9	10.7	11.7
Year 21-30						
Sawtimber	7.4	9.6	11.1	9.3	8.0	9.8
Pulpwood	10.5	8.5	9.7	9.1	7.4	8.7
	17.9	18.1	20.8	18.4	15.4	18.5

* Baseline volumes are based on the average volume of pine sawtimber and pulpwood harvested from 1987-89, prior to implementation of Interim S&Gs.

Table F-9B
**Estimated Employment Levels Generated by National Forest Timber Harvest.
Jobs per Fiscal Year - Francis Marion NF**

Time Period	Baseline Empl.*	Alternatives A	B	C	D	E
Year 1 - 10	170	160	170	160	150	160
Year 11 - 20	170	110	110	110	100	110
Year 21 - 30	170	170	200	170	150	170

* Baseline employment is based on the average employment generated by harvest of National Forest timber in 1988 - 89, prior to implementation of Interim. It has been adjusted to account for the effects of Hurricane Hugo.

Table F-9C
**Estimated Income Levels Generated by National Forest Timber Harvest.
Millions of Dollars per Fiscal Year - Francis Marion NF**

Time Period	Baseline Income*	Alternatives				
		A	B	C	D	E
Year 1 - 10	4	4	4	4	4	4
Year 11 - 20	4	3	3	3	3	3
Year 21 - 30	4	4	5	4	4	4

* Baseline income is based on the average income generated by harvest of National Forest timber in 1988-89, prior to implementation of Interim.

Table F-9D
**Estimated Payments to States Generated by National Forest Timber Harvest.
Millions of Dollars per Fiscal Year - Francis Marion NF**

Time Period	Baseline* Payments	Alternatives				
		A	B	C	D	E
Year 1 - 10	0.6	0.5	0.6	0.5	0.5	0.5
Year 11 - 20	0.6	0.1	0.1	0.1	0.1	0.1
Year 21 - 30	0.6	0.7	0.8	0.7	0.6	0.7

* Baseline payments to states are based on the average payments generated by harvest of National Forest timber in 1987-89, prior to implementation of Interim. Baseline rates are presented in 1994 values.

Table F-10A
Estimated Harvest Levels by Alternative and Time Period.
Millions of Board Feet per Fiscal Year - Cherokee NF

Time Period	Baseline* Volume	Alternatives A	B	C	D	E
Year 1-10						
Sawtimber	10.8	9.6	9.8	9.5	9.2	9.5
Pulpwood	4.3	4.1	4.1	4.0	3.9	4.0
	15.1	13.7	13.9	13.5	13.1	13.5
Year 11-20						
Sawtimber	10.8	9.6	10.1	9.6	9.2	9.6
Pulpwood	4.3	4.1	4.1	4.1	3.9	4.1
	15.1	13.7	14.2	13.7	13.1	13.7
Year 21-30						
Sawtimber	10.8	9.8	10.6	9.7	9.2	10.0
Pulpwood	4.3	4.0	4.3	4.2	3.8	4.1
	15.1	13.8	14.9	13.9	13.0	14.1

* Baseline volumes are based on the average volume of pine sawtimber and pulpwood harvested from 1987-89, prior to implementation of Interim S&Gs.

Table F-10B
Estimated Employment Levels Generated by National Forest Timber Harvest.
Jobs per Fiscal Year - Cherokee NF

Time Period	Baseline Empl.*	Alternatives A	B	C	D	E
Year 1 - 10	140	130	130	130	120	130
Year 11 - 20	140	130	130	130	120	130
Year 21 - 30	140	130	140	130	120	130

* Baseline employment is based on the average employment generated by harvest of National Forest timber in 1988 - 89, prior to implementation of Interim.

Table F-10C
Estimated Income Levels Generated by National Forest Timber Harvest.
Millions of Dollars per Fiscal Year - Cherokee NF

Time Period	Baseline Income*	Alternatives				
		A	B	C	D	E
Year 1 - 10	4	3	3	3	3	3
Year 11 - 20	4	3	3	3	3	3
Year 21 - 30	4	3	4	3	3	3

* Baseline income is based on the average income generated by harvest of National Forest timber in 1988-89, prior to implementation of Interim.

Table F-10D
Estimated Payments to States Generated by National Forest Timber Harvest.
Millions of Dollars per Fiscal Year - Cherokee NF

Time Period	Baseline* Payments	Alternatives				
		A	B	C	D	E
Year 1 - 10	0.8	0.7	0.7	0.7	0.6	0.7
Year 11 - 20	0.8	0.7	0.7	0.7	0.6	0.7
Year 21 - 30	0.8	0.7	0.7	0.7	0.6	0.7

* Baseline payments to states are based on the average payments generated by harvest of National Forest timber in 1987-89, prior to implementation of Interim. Baseline rates are presented in 1994 values.

Table F-11A
Estimated Harvest Levels by Alternative and Time Period.
Millions of Board Feet per Fiscal Year - NF's in Texas

Time Period	Baseline* Volume	A	B	Alternatives C	D	E
Year 1-10						
Sawtimber	59.5	44.3	47.8	42.8	39.6	47.8
Pulpwood	22.5	19.2	19.9	18.8	16.9	19.9
	82.0	63.5	67.7	61.6	56.5	67.7
Year 11-20						
Sawtimber	59.5	45.5	51.3	45.5	40.2	51.3
Pulpwood	22.5	19.9	20.0	20.2	17.8	20.0
	82.2	65.4	71.3	65.7	58.0	71.3
Year 21-30						
Sawtimber	59.5	48.4	57.1	46.9	39.6	49.8
Pulpwood	22.5	19.0	22.0	20.7	16.0	19.4
	82.0	67.4	79.1	67.6	55.6	69.2

* Baseline volumes are based on the average volume of pine sawtimber and pulpwood harvested from 1987-89, prior to implementation of Interim S&Gs. Baseline volume reflects reductions caused by the 1988 court ordered plan.

Table F-11B
Estimated Employment Levels Generated by National Forest Timber Harvest.
Jobs per Fiscal Year - NF's in Texas

Time Period	Baseline Empl.*	Alternatives A	B	C	D	E
Year 1 - 10	770	600	640	580	530	640
Year 11 - 20	770	620	670	620	550	670
Year 21 - 30	770	630	740	640	520	650

* Baseline employment is based on the average employment generated by harvest of National Forest timber in 1988 - 89, and reflects effects of the court ordered plan.

Table F-11C
**Estimated Income Levels Generated by National Forest Timber Harvest.
Millions of Dollars per Fiscal Year - NF's in Texas**

Time Period	Baseline Income*	Alternatives				
		A	B	C	D	E
Year 1 - 10	20	15	16	15	14	16
Year 11 - 20	20	16	17	16	14	17
Year 21 - 30	20	16	19	16	13	17

* Baseline income is based on the average income generated by harvest of National Forest timber in 1988-89, and reflects effects of the court ordered plan.

Table F-1D
**Estimated Payments to States Generated by National Forest Timber Harvest.
Millions of Dollars per Fiscal Year - NF's In Texas**

Time Period	Baseline* Payments	Alternatives				
		A	B	C	D	E
Year 1 - 10	4.1	3.1	3.3	3.0	2.8	3 3
Year 11 - 20	4.1	3.2	3.6	3.2	2.8	3.6
Year 21 - 30	4.1	3.4	4.0	3.3	2.8	3.5

* Baseline payments to states are based on the average payments generated by harvest of National Forest timber in 1987-89, prior to implementation of Interim. Baseline rates are presented in 1994 values. Baseline payments reflect the effects of the court ordered plan.

APPENDIX G

SCIENTIFIC SUMMIT ON THE RED-COCKADED WOODPECKER

I. Executive Summary

From March 28 to 30, 1990 twenty-four experts on the red-cockaded woodpecker (RCW) convened in Live Oak, Florida to address the issues which are crucial to the recovery of the species. The Summit was conducted to examine the scientific basis of management decisions affecting the RCW. To the extent possible, the intent of the Summit was to develop consensus about the biological needs of the RCW and make recommendations for managing its recovery.

Numerous areas of consensus emerged concerning the biological characteristics and needs of the RCW. In addition, several management initiatives were recommended to enhance the condition of the RCW. Both short-term and long-term needs of the species were discussed, as well as the varying characteristic of different forest types in different regions of the RCW's range.

The primary management initiatives recommended are:

1. begin managing the RCW on an areawide basis rather than the current system of managing areas contiguous to colony sites;

2. incorporate the changes to the Recovery Plan recommended by the Summit; then provide sufficient resources to implement the recovery plan in full;

3. develop an emergency action plan (as outlined in Section VIII) to stop the decline of small and sensitive colonies or populations;

4. form a broad-based Technical Advisory Committee to assist government agencies in developing management guidelines for the RCW.

The implementation of these recommendations will likely require new or re-allocated resources and management guidelines. Nonetheless, Summit participants strongly expressed the need for new initiatives to reverse existing trends in RCW population dynamics under most conditions.

II. Introduction

The fate of the red-cockaded woodpecker (RCW) has been the center of considerable debate and discourse during the past two years. Environmental and conservation groups, forest products and timber associations, the U.S. Forest Service and the U.S. Fish and Wildlife Service have been involved in various ways with the issues pertaining to the management of the RCW.

In late March 1990, 24 biologists and resource managers, widely respected experts on the RCW, convened to address the plight of the RCW. The Summit was convened by the National Wildlife Federation. The participants came from academic institutions, state and federal agencies, consultants and the private sector. Efforts were made to include participants representing the range of perspectives which exist among different organizations and agencies. The Summit was facilitated by the Southeast Negotiation Network (SSN), a program of the Georgia Institute of Technology.

SSN is a public policy program which, among other activities, provides neutral assistance for facilitating discussions and mediating the resolution of complex and controversial issues of public interest.

The Summit was conducted to focus participants on the issues critical to the management and survival of the RCW. A preliminary agenda was developed from comments submitted prior to the Summit by the major organizations and agencies involved with the RCW. Participants at the Summit were then given the task of setting priorities and identifying the most important issues for discussion. This formed the basis for the final agenda of the Summit.

The four stated objectives of the Summit were to:

1. develop consensus among scientists about the biological requirements of the RCW;

2. develop a list of research needs for the management and recovery of the RCW;

3. develop guidelines for best forest management practices which would halt the decline of the RCW and ensure its survival;

4. address the tension between managing for the RCW and managing for other uses of National Forests.

Significant discussion occurred concerning the appropriate focus of the Summit. Some argued for focusing primarily on the overarching policy issues which are needed to increase the probabilities of survival and enhancement of the RCW. Incorporated in this line of thinking was that existing approaches to the problem, including the Recovery Plan, may not be sufficient. On the other hand, some argued that the Recovery Plan would be sufficient if it were properly implemented. Few situations exist, however, where the Recovery Plan has been applied completely and evaluated. As such, most participants agreed that more information is needed to evaluate fully the adequacy of the Recovery Plan. (Recovery Plans are a requirement of the Endangered Species Act. The U.S. Fish and Wildlife Service is the agency responsible for developing recovery plans. The RCW Recovery Plan was developed in 1979 and revised in 1985. The revised version is the focus of current discussions.)

The result of these discussions led to a two-prong approach to managing the Summit, integrating the interests of both viewpoints. First, regardless of new policy initiatives, the Summit would be used to evaluate the Recovery Plan (since it provides present guidelines for management decisions), make recommendations about how it might be improved given the best information available about the biological requirements of the bird, and discuss what is needed to implement the Recovery Plan fully so its adequacy can be better evaluated. The contents of the Recovery Plan served as the framework for discussions about population dynamics, nesting and foraging requirements.

Second, some time would be given to discussing the overall policies guiding RCW management decisions. Participants acknowledged that policies governing the management of the RCW and the implementation of those policies should be re-examined. Furthermore, they acknowledged that more support for implementing existing policies and improving the condition of the RCW should be provided immediately. New policy initiatives should be promoted as necessary to lead to action.

The final agenda for the Summit centered on the following topics, realizing that given the time allocated, the Summit would probably be only the first step in focusing greater attention on saving the red-cockaded woodpecker:

- o Historical habitat of the RCW
- o Population dynamics
- o Nesting requirements
- o Foraging requirements
- o Integrated management concepts, including ecosystem management, the role of fire, even versus uneven aged management, etc., line of sensitive
- o Management practices necessary to stop the decline of sensitive populations.
- o Research needs
- o Policy initiatives.

The remaining portion of this report summarizes the discussions of these issues, and indicates points on which general consensus was reached. Bold lettering is used to indicate points of general consensus. "General consensus" implies general agreement among the participants as expressed during the joint discussions and as supported by the summaries of working group discussions. The contents of this report are taken directly from the group notes compiled from working and plenary session discussions conducted during the Summit.

III. Historical Perspectives

A discussion of the historical range and habitat of the RCW was initiated by several participants who have studied historical conditions of the RCW as a way to understand better the decline of the RCW and how that trend can be reversed. Historically, the red-cockaded woodpecker covered a wide range in eleven to thirteen states. The range extended from Texas in the west, to Florida in the south, to New Jersey in the north, although North Carolina represents the normal northern extent of the RCW. Historically, longleaf pine forests were the primary habitat for the RCW, although over much of its range shortleaf and loblolly pines also support RCW populations.

A characteristic of the longleaf pine forest important to the RCW is the fire regime. Fire during the growing season is recognized as a key factor in the sustenance of the RCW. The loss of longleaf forests has resulted in the loss of associated grasses that helped fuel fire crucial to these ecosystems and the RCW. Furthermore, as the use of managed fires has become more restricted in the past forty years, the detrimental impacts of the lack of fire on the RCW have increased.

Logging, agricultural and urban expansion have all resulted in negative impacts on the RCW and its preferred forest conditions. The invention of the chain saw in the 1940's created particular problems as clearcutting took on new dimensions. Prior to the chain saw, cutting was much more selective and culls remained which ultimately provided habitat for the bird.

Differences in soil types and geography also have impacts on the RCW as different conditions are often found in comparing habitat in coastal plain, piedmont and mountain areas.

IV. Population Dynamics

Based on the participant survey, the following ten population dynamics issues were identified as most important based on the frequency of response:

1. What is a viable population?

2. Do populations exist that are not worth managing? If so, what criteria can be used for determining such populations?

3. What leads to the extinction of RCW?

4. Are inactive colony sites essential to the RCW?

5. What is the importance of movement and dispersal to the colonization of new areas?

6. Can RCW habitat be increased by artificial cavities?

7. Crisis management - what should be done with small, isolated populations?

8. What should be the priorities for population management, with reference to the allocation of resources?

9. Research needs on the translocation of the RCW to unoccupied suitable habitat.

10. Survey of population size.

Research issues (9 and 10) are discussed with the section on research needs.

Many comments focused on the importance of dispersal, fragmentation, quality of habitat and current population health to population dynamics. The discussions also addressed what constitutes a viable population. A point of consensus on this issue is that no population should be considered unworthy to be saved. In this context, the concept of a "viable" population is not appropriate. Where active colonies exist, efforts should be made to assist the propagation of the RCW. General agreement also emerged that, given the extent of fragmented habitats and isolated populations, management decisions should be based on the recognition of that reality and the resultant vulnerability. Fragmented habitats and isolated populations are the norm rather than the exception.

A variety of other population dynamics issues were discussed. These include the observations that:

- distinctions need to be made between short-term and long-term needs of and impacts on the RCW;

- while genetic concerns are important, environmental and stochastic factors play a crucial role in viability;

- since the long-term recovery of the bird is mandated, viability ought to be discussed in those terms; only

- in recognition that few populations approach the desired size for recovery, strategies for dealing with smaller populations are necessary;

- research on the survival probability of various colony sizes as a function of isolation, habitat and management potential should be conducted;

- management objectives ought to be consistent with forest ecosystem management; the needs of the bird will be met if this is accomplished;

- as a keystone species, managing for the RCW equates to managing for the entire ecosystem;

- single species management leads to problems in the long-term.

A series of thresholds for describing RCW populations were identified that could impact future management decisions. Incorporated in this hierarchy is the concept that policies and management decisions should be different for different population conditions. This continuum ranges from:

- zero population, but potentially good habitat which could be occupied;

- a small number of breeding pairs (six to seven) which can be sustained for a twenty year period even in a semi-isolated condition;

- a genetically desirable condition of twenty-five breeding pairs for short-term sustainability of a population (fifty years);

- a desirable condition of 400 breeding pairs to achieve long-term recovery of populations.

The Recovery Plan guidelines are based on managing for an effective population size of 250 breeding pairs. Consistent with the availability of adequate habitat, the RCW should be managed for a density of one clan per 200 to 400 acres. The range of 200 to 400 acres provides for management flexibility based on the quality of the habitat. The discussion of population dynamics was closed by addressing three issues which link scientific knowledge to management principles; the size of individual populations needed for long-term viability, the amount of adequate habitat needed to support the populations, how many populations are needed for recovery, and what constitutes an individual population. Each of these issues are addressed by the Recovery Plan. Participants reached broad consensus based on the available information, but also indicated more data are desirable. The general areas of agreement were:

1. Based on new research, participants agreed that **the size of individual populations needed to achieve an effective population size of 250, and to maximize long-term recovery, should be 400 breeding pairs.** This is based on the understanding that each pair will not successfully breed each year. Discussion occurred concerning whether breeding pairs or census information on actives colonies be used as the measure of population size. Counting breeding pairs was more widely considered to be the appropriate measure.

2. Participants also agreed that **providing adequate habitat for a density of one clan per 200 to 400 acres is sufficient.** If acreage within a jurisdictional boundary (e.g., a National Forest) is not sufficient to support 400 breeding pairs, the habitat should be managed for the maximum population size possible based on the density of one clan per 200 to 400 acres. Discussion about the impact of single males on population counts, and the associated acreage of habitat ensued. Research indicates that single males can comprise as high as 25 percent of active colonies. As such, basic agreement was reached that **the number of acres needed for management of the population should be based on the 400 breeding pairs plus 100 (25 percent 01 400), i.e., 500 active colonies,** in the absence of site specific information about the percentage of single males. The base figure of 400 breeding pairs is the fail safe value if no site specific information is available to indicate that a population is recovering with fewer breeding pairs.

3. The Recovery Plan indicates that 15 distinct populations are desirable to assure the future of the species. In the absence of better information, **consensus exists about the adequacy of 15 distinct populations leading to the long-term recovery of the RCW.** Some participants suggest, however, that the figure be reevaluated and increased in light of information about the historical range of the RCW.

4. Concerning the spatial boundaries of individual populations, concurrence with the recovery plan exists with some important caveats. Eighteen miles is an acceptable distance given the general range of the bird although exceptions exist. Therefore, eighteen miles should be used only in the absence of available site information about the interaction among colonies. **Furthermore, eighteen miles is acceptable only where no discontinuity exists of greater than five miles.** A discontinuity is defined as a barrier to the dispersal of the bird such as unsuitable habitat. If such a barrier exists, different populations may be defined at less than eighteen miles. The other caveat is caution against stringing together isolated colonies which may be at the outer extreme of dispersal range. For example, considering isolated colonies 40 to 50 miles from the main colony to be part of the same population, connected only by isolated colonies 15 to 18 miles apart, may be inappropriate.

It was noted again that many existing colonies will not likely be associated with one of the targeted fifteen populations. Where a target of 400 breeding pairs is not likely to be achieved given habitat, acreage or other limitations, different goals may be more appropriate for such colonies to ensure their survival. For example, with small, isolated and declining populations, a three-phased goal of stabilizing the population, managing for the return to historic population size and then managing for a population which can be supported by the habitat may be realistic model.

Points of Consensus - Population Dynamics

1. The use of the term "viable population" should be considered in light of the consensus that no existing population is unworthy to be saved.

2. Where populations exist today, efforts should be made to stabilize and increase the population.

3. To be realistic, RCW management decisions should be based on the presence of fragmented habitat and isolated populations as the norm, not the exception.

4. In the absence of site specific data, 400 breeding pairs constitutes a desirable population size for the recovery of a population.

5. To provide adequate habitat, 200 to 400 acres per clan should be available.

6. Since up to 25 percent of colonies may be occupied by single males, this should be accounted for in the determination of the necessary breeding pairs and/or the acreage needed to support the population (e.g., 400 breeding pairs translates to 500 active colonies for habitat management practices).

7. At a minimum, fifteen distinct populations (as defined above) distributed throughout its natural range is acceptable as a target number of populations to lead to the recovery of the species.

8. Colonies separated by less than eighteen miles will be considered part of the same population unless discontinuities (barriers to dispersal) of five miles or greater exist. If discontinuities exist, distinct populations may exist within the eighteen mile area. If no discontinuities exist, colonies separated by more than eighteen miles will still be considered different populations.

9. Items four through eight are appropriate guidelines based on the existing data base. Ultimately, more information is desirable to support these guidelines.

V. Nesting Requirements

Discussions of nesting and foraging requirements were included in the discussion of populations dynamics as well as with the discussions of integrated management practices. While less time was allocated specifically to these two issues in comparison to population dynamics, discrete discussions focused on the nesting and foraging requirements of the RCW.

Based on the frequency of participant response to the survey, the following five nesting issues were identified as most important.

1. Minimum area to be treated in colony sites for hardwood removal that is effective in reducing competition and predation.

2. Retain or remove snags in colony sites?

3. Does even-aged management disrupt RCW colonies?

4. Do we need to remove over-story hardwoods in colony sites?

5. (a) What are the stand characteristics of good nesting habitat?
   (b) Best technique for regenerating a stand around an RCW colony.

Most of these issues were discussed in greater detail in the context of integrated management issues. The primary issues discussed in this section are those addressed by the Recovery Plan.

The Recovery Plan presents the following guidelines for achieving appropriate nesting habitat for the RCW:

- Trees should be more than 60 years old; preferably, loblolly should exceed 70 years and longleaf 80 years.
- The presence of red heart is important; typically, it is found in loblollys greater than 70 years old and longleaf greater than 100 years old.
- In colony sites, hardwood BA should be limited to less than 20 square foot.
- Open, park-like stands should be achieved with 60-90 pine BA, given observed ranges of 10-150 pine BA.
- All hardwood stems greater then 1" should be removed within 50 ft from a cavity tree.
- To reduce the risk from the SPB, 20 to 25 ft spacing between trees should be maintained.
- Manage stands - do not isolate from foraging areas.

As with population dynamics, the participants agreed in general with the guidelines in the Recovery Plan although recommend some significant modifications. Pertaining to tree age, participants acknowledged that the presence of red heart is crucial to nesting habitat. As such, **management decisions ought to be based on providing tress which have sufficient red heart for nesting. Target age conditions recommended are: longleaf, 100-250 plus years; shortleaf, 80-150 years; and loblolly, 80-120 years.** These age guidelines should replace existing guidelines in the Recovery Plan. Criteria for determining the rotation include heartwood diameter, frequency of red heart occurrence and abundance of trees with the proper characteristics to provide sustainable yield.

Significant discussions occurred about the blanket removal of hardwoods in a colony site. The sense of the group was that rather than having a numeric guideline (less than 20 square feet hardwood BA) the goal ought to be to prevent conditions such that a wall of hardwoods or other midstory encroaches on cavity trees. A distinction should be made between managing around cavity tress and within nesting habitat. **Overstory and midstory control within 50 feet of a cavity trees desirable. Pine and hardwood midstory in nesting habitat should also be eliminated or minimized, but some pine retained for regeneration.** While desirable to remove hardwoods which would create midstory problems, selected hardwoods should perhaps be retained for foraging. Certain hardwood species might be identified as appropriate to retain (e.g., dogwood, persimmon) for that purpose. Local managers should be provided discrete guidelines but allowed some flexibility to make these decisions.

Participants support the concept of an open, park-like stand but do not agree with the target pine BA. **The recommendation of participants is that the optimal and operational BA should be 60-90. Thinning should occur only when 90 BA is exceeded, and thinning should not exceed the removal of more than 30 BA,** to avoid sudden and drastic habitat modification.

Finally, clumps of trees are desirable for habitat not just solitary trees. As such, the 20-25 foot spacing suggested by the Recovery Plan to reduce the risk of the SPB should be modified to state that **average spacing should be 20-25 feet, retaining clumps of nesting trees.** By explicitly referring to average spacing, the tendency to remove potential nesting trees to comply with the existing language will be resolved.

Points of Consensus - Nesting Requirements

1. Management decisions ought to be based on providing tress which have sufficient red heart for nesting. Target age conditions recommended are: longleaf, 100-250 plus years; shortleaf, 80-150 years; and loblolly, 80-120 years.

2. Overstory and midstory control within 50 feet of a cavity tree is desirable. Pine and hardwood midstory in nesting habitat should also be eliminated or minimized, but some pine retained for regeneration.

3. The recommendation of participants is that the optimal and operational BA should be 60-90. Thinning should occur only when 90 BA is exceeded, and thinning should not exceed the removal of more than 30 BA.

4. To reduce the risk of the SPB, the Recovery Plan should be modified to state that average spacing should be 20-25 feet, retaining clumps of nesting trees.

VI. Foraging Requirements

Based on the frequency of response to the issues survey, the following issues were identified as most important:

1. How should foraging habitat be configured?

2. What age, tree species, average basal area, average diameter, stems per acre do RCW prefer for foraging area?

3. (a) How much foraging area is needed?
   (b) What is the basis for defining foraging areas?

   -trees?
   -total basal area?
   -acres?
   -bark surface area for foraging'?

4. (a) What type of hardwood control is needed in foraging areas?
   (b) Importance of regional variation to foraging?

The discussions of RCW foraging requirements were similar to those on nesting requirements. The Recovery Plan guidelines were used as the framework. The Recovery Plan provides the following guidelines: sufficient substrate contiguous to a colony site will be provided; the amount of acreage needed for 6350 stems greater than 10" dbh and 8490 square feet BA pine stems in stands over 30 years, within 0.5 miles of a colony. **Participants generally agreed with the Recovery Plan guidelines. Several issues were discussed, however, which might lead to modifications in the Recovery Plan.**

A description of foraging ecology was advanced as a method of examining the needs of the RCW. In summary, foraging is conducted as a social unit rather than singly. However, males and females have different foraging needs, as males seem to prefer small tress and the tops of large trees while females prefer trunks of large trees. Tree preference is 90 percent pine and 10 percent hardwoods. The RCW occasionally eats fruit but typically feeds on invertebrates taken from loose bark. The RCW prefers larger stems, generally over 10" dbh. The preferred foraging area is 60-90 BA. The RCW also seems to prefer a mixed age forest for foraging needs. Discontinuities in the canopy, stands of trees, proximity to its colony, and proximity to other colonies each can affect foraging of the RCW and should be addressed by the overall management plan.

While midstory hardwoods are clearly identified as detrimental in colony sites from a nesting perspective, this is not as definitive for foraging habitat. Extensive hardwood midstory has shown to be detrimental to female foraging. On the other hand, in nesting season, foraging often takes place close to the colony. Therefore, the availability of some appropriate foraging habitat near the colony site can be important. This issue and possible solutions were discussed with nesting requirements.

VII. Integrative Management Practices

Many existing and potential RCW management practices impact more than one facet of RCW habitat. For the purposes of discussion at the Summit, these were termed integrative management practices. Four major issues were addressed that are affected by existing management practices and should be addressed in further management plans. These are:

- the utilization of ecosystem management rather than single species management;
- the role of fire in RCW management and the impacts of fire suppression;
- the differing characteristics and impacts of even and uneven aged management;
- the impacts of fragmentation and isolation on the RCW.

Utilization of Ecosystem Management

Whether to follow a basic philosophy of single species management or ecosystem management is clearly an issue of debate. Most participants support the concept of ecosystem management as crucial to the long-term recovery of the RCW. Both views share the concept that the conditions under which the RCW thrives should be defined. The differences are encountered in the method of achieving those ideal conditions. Furthermore, practical considerations to implementing the ecosystem management philosophy need to be addressed.

Two fundamental questions were raised in conjunction with this discussion; do current management practices for the woodpecker negatively impact other species or uses of the forest? In comparison to current management practices, would ecosystem management practices lead to positive impacts on other sensitive species characteristic of fire climax ecosystems?

Ecosystem management involves managing the ecosystem as nature does. Natural variables affecting a forest and associated habitat include fire, storms, insects, soils, geologic relief and the influence of humans. An issue vital to ecosystem management is defining the historical ecosystem to be used as the goal of management objectives. What is the template guiding management decisions? This involves understanding the historical variability throughout the range of the RCW.

In ecosystems inhabited by the RCW, historical conditions are characterized by the development of old growth trees in an all age forest with even aged patches, where the even aged patches vary in size. Another descriptor often used for RCW habitat is the presence of open, park-like stands of pines or pine/hardwoods. Fire is an important natural event crucial to maintaining the ecosystem (discussed below). Without the use of fire, ecosystem management becomes problematic.

Ecosystem management has different implications for different types of pine forests. For example, the timing of the burning season would potentially vary between loblolly and longleaf forests. **In longleaf systems, however, ecosystem management is characterized by growing season fire and lengthened rotations.** Differing views are held concerning the most appropriate type of harvesting, among single tree (depending on the size of the opening created), small group selection and small patch cuts. The basic premise is that management practices should be designed to mimic the natural system.

In the absence of fire, the use of mechanical and chemical means of achieving is possible but does not achieve all the attributes of growing season fire to the ecosystem as a whole. Furthermore, mechanical and chemical methods may be adversely affected by limitations on the funding necessary to achieve the appropriate level of control on a broad scale. A suggested approach to implementing ecosystem management in light of current policies is **to begin with applications on small units which are prime RCW habitat.** If it proves successful, and feasible on a larger scale, the approach can be applied to additional areas. A priority list of those units/areas that would most benefit from ecosystem management, and demonstrate its value and applicability, should be developed.

The Role of Fire in RCW Management and the Impact of Fire Suppression

As has been noted, fire is a natural occurrence that is important to the maintenance of RCW habitat. In the absence of fire, mechanical and chemical alternatives can be applied but not with the effectiveness and overall benefits of fire. In recent times, however, the use of managed fires has decreased due to environmental and safety considerations. Regardless of whether an ecosystem management philosophy is initiated, the role of fire and its suppression need to be examined.

A better understanding of the legal and environmental barriers to fire is needed among managers of the RCW. The barriers are numerous. They include regulatory constraints such as the Clean Air Act and state laws governing smoke management, public safety and liability issues, funding and personnel issues, policies based on risk aversion, and public education about the value of and need for managed fire in some systems.

Alternatives for overcoming barriers to controlled fire should be developed and analyzed. In south Florida, smoke easements are obtained from property owners to allow for managed fires. While this may not be widely applicable it exemplifies possible options for using fire. Another alternative is to institute policies that encourage fire where fire can be used, and provides for adequate alternatives in areas where it cannot.

This implies that a survey of units be conducted that identifies those where fire can be used and encouraged, and those units where fire will be prohibited. While this information exists for specific forests, a more unified approach and explicit policy may be helpful to managers. Cooperating and working more closely with agencies responsible for administering the Clean Air Act might also be helpful.

Assuming managed fires can be utilized the following guidelines are suggested. **Burning should be conducted in the growing season**. The full benefits of fire are not achieved from non-growing season burns. The recommended frequency between burns varies with the type of pine forest. **In longleaf systems, two to six years between burns is suggested. In loblolly and shortleaf systems, two to five years is appropriate for midstory control, protecting areas of new growth from fire for twelve to fifteen years.**

Even versus Uneven Aged Management

The debate between the relative benefits and detriments of even aged and uneven aged management was addressed by Summit participants. In the course of discussion, the benefits and drawbacks of both systems to the RCW were identified. Suggestions for overcoming the potentially adverse impacts of either system were also discussed.

The identified benefits of uneven aged management (single-tree method) to the RCW include: minimizes fragmentation, provides total habitat availability for foraging, reduces beetle hazard, minimizes impacts of stochastic events and is associated with higher public acceptance. The identified drawbacks of the single tree method include: technical feasibility (logistics are difficult), site disturbance (roads), burning is difficult in some systems (loblolly) and pine midstory problems might be created. The relative benefits of the group selection method of uneven aged management include its applicability to all pine forest types and ease of fire use compared to the single tree method. The drawbacks are similar to the single tree method but relate primarily to the questionable assurance of adequate nesting habitat without specifying age for harvesting.

The two major types of even aged management systems are clearcutting and shelterwood/seed-tree. The identified benefits of clearcutting include: ease of controlling midstory problems, relatively minimal logistics, ease of fire management, more control over structure/stocking, and facilitates conversion back to more desirable species. The drawbacks identified include: increases the potential for fragmentation, may require intensive site preparation, may increase beetle risk and is generally not well received by the public.

The benefits of the shelterwood/seed-tree system identified include: option of retaining residuals is available, mimics growth patterns desired by the RCW, reduces fragmentation if residuals remain, minimizes costs of regeneration, guarantees the provision of old growth trees of known age, foraging and nesting is available on greater acreage (for length of time residuals remain), provides ability to control the distribution of residuals, and has greater public acceptance. The identified drawbacks of the system are limited to the potential increased risk to residuals and the need for midstory control if residuals are occupied by the RCW.

Most RCW populations in today's forests occur in systems controlled by even aged management. However, critics of even aged management cite the scale on which it is implemented, the loss of older tress which might provide nesting habitat before younger trees come of age for the RCW, and intensive site preparation as detrimental to the RCW. Participants agree, however, that most of these problems can be overcome by the way in which even aged blocks are achieved.

The primary recommendation from the participants is that plantation management schemes be replaced with other approaches. The suggested alternative is a shelterwood/seed-tree system. This system results in several desirable benefits if managed appropriately (ie., planning for and maintaining residuals). Natural regeneration occurs rather than planting. This has several attributes, one of which is reduced cost. This system also results in a continuous age distribution and increases the assurance of desired old growth. Additionally, such a system alleviates concerns about fragmentation and isolation.

Where clearcutting is used, it is recommended that areas clearcut be limited to a maximum of ten acre patches. At this scale, the major drawbacks of clearcutting are minimized. Flexibility should be built into policies to allow the use of some uneven aged management where the conditions indicate benefits would accrue (e.g., related to foraging needs).

Fragmentation and Isolation

The potential problems of fragmented habitats and isolated colonies are well documented. Early in the Summit, participants acknowledged that the context of all discussions about the RCW should assume fragmented habitats and isolated populations. While these characteristics may not be totally detrimental to the RCW, it is generally acknowledged that the problems associated with fragmentation and isolation far outweigh the benefits. The loss of corridors between different colonies creates barriers which reduce the interaction among colonies and causes isolation. While some isolated colonies can exist for several years, the long-term prognosis for such colonies is not positive.

Several recommendations made concerning population dynamics, nesting, foraging, ecosystem management, fire and timber harvest systems will reduce fragmentation and isolation. For example, if rotations are long enough as described in nesting section, and if a properly managed shelterwood/seed-tree system is implemented as described above, the problems associated with fragmentation and isolation will be greatly reduced. Attention should be given, however, to the practice of clearing around a colony site. Clearing on three sides and maintaining a corridor on one side, based on the assumption that the one side maintains a corridor, may not be accurate. The remaining corridor may not be used under such conditions.

Points of Consensus - integrative Management

1. In longleaf systems, ecosystem management should be characterized by growing season fire and lengthened rotations. Management practices should mimic the natural system.

2. Implementing ecosystem management should begin with applications on small units which are prime RCW habitat.

3. Alternatives for overcoming barriers to controlled fire should be developed and analyzed.

4. Burning should be conducted in the growing season.

5. In longleaf systems, two to six years between burns is suggested. In loblolly and shortleaf systems, two to five years is appropriate for rnidstory control, protecting areas of new growth from fire for twelve to fifteen years.

6. Plantation management schemes should be replaced with other approaches. The suggested alternative is a shelterwood/seed-tree system.

7. Where clearcutting is used, clearcut areas should be limited to a maximum of ten-acre patches.

VIII. Emergency Actions to Stop the Decline of the RCW

Consensus was reached among the participants that an emergency plan for stopping the decline of small and sensitive colonies or populations is needed. This requires a different focus from the plans for long-term recovery of the RCW. Ideally the two are linked, such that the emergency plan begins the process of long-term recovery and becomes integrated into processes for achieving long-term recovery. The objective stated by Summit participants, however, is that a sense of immediacy is necessary to stop the decline and stabilize populations in most situations.

The following summary captures the consensus of participants about what needs to occur immediately to stabilize sensitive and declining populations. Generally defined, sensitive populations are management units with less than 50 active colonies. **(An assessment of how many RCWs are in this situation populations is recommended.)** While participants agreed that each population should be categorized into a priority system for emergency actions, they also reinforced that every population is worthy of being saved. The following field and administrative recommendations comprise an emergency action plan:

Field Initiatives

1. **Implement mid-story and under-story control practices around all active colonies.** Mechanical and chemical methods may be needed initially but growing season fire should then be used where possible as the primary method of control. A suggested priority scale for implementing mid-story control practices is first active colonies, then inactive colonies followed by foraging areas and new/potential colonies.

2. **Repair cavities or use restrictors as necessary.** It was noted that some restrictors do not function well due to improper installation. Attention must be given to proper installation practices.

3. **Construct artificial cavities in colony sites or potential colony sites.** In general, preference was shown for repairing cavities or using restrictors before utilizing artificial cavities. In many cases it is acknowledged, however, that artificial cavities will be the only option. In such cases, a suggested implementation hierarchy is first the use of starts, then drilling in trees with adequate diameter, followed by inserts on smaller trees. A target of four artificial cavities per colony was suggested.

4. **Implement an augmentation program.** Single bird colonies should be identified and given priority if appropriate habitat and other conditions exist. The site should be evaluated for success before augmentation is undertaken. The introduction of juvenile birds should be the subject of further investigation.

5. **Use state-of-the-art SPB suppression techniques to protect cavity tress.** The southern pine beetle is not a problem in longleaf systems. In shortleaf and loblolly systems, however, the SPB is a major consideration. Protection in the winter season is important and current efforts to utilize repellents to reduce losses should be supported.

To maximize the effectiveness of the program, **increased monitoring is recommended as a necessary part of the emergency action plan.** The above suggestions pertain not only to active colony sites. **Where acceptable habitat remains, every effort should be given to recovering abandoned sites** through the use of restrictors, artificial cavities and, if needed, midstory habitat enhancement.

Administrative Initiatives

1. **Implement policies to protect relicts and old pine stands.** This is strongly supported as a mechanism to support both the immediate and long-term recovery of the RCW.

2. **Continue and promote the general objectives of the interim guidelines regarding cutting for declining and sensitive populations.** The details of the interim guidelines are still in the process of being developed at the time of writing this report. Support for this concept is in terms of the general objectives, and is not based on the specific details of the guidelines.

3. **Provide incentives to ensure implementation.** The general concept is that some type of incentives program for field personnel and managers of public lands should be instituted to encourage proactive actions for stabilizing declining and sensitive populations in particular. A different type of incentives program might be developed for private land owners and managers.

4. **Increase enforcement of existing regulations.** A specific suggestion pertaining to enforcement is the enforcement of RCW policies on military lands. Problems with management practices on state lands have also been noted. Suggestions for addressing this problem include the U.S. Forest Service exercising greater control over management practices through the provision of funds (Section 7) and modifying existing policies.

5. **Increase educational opportunities for field personnel on implementing emergency techniques.** One specific educational recommendation is to conduct a workshop for U.S. Forest Service and other RCW field personnel on the proper installation and use of restrictors. Another recommendation is that efforts be made to educate the public as well as policymakers about the plight of the RCW and its habitat.

Detailed inventories of RCW populations on both public and private lands is strongly recommended to validate trends. Such a survey might be especially important to identify colonies, foraging areas or potential habitat on private lands near marginal populations on public lands. **Polices that encourage the maintenance of corridors to protect or create linkages between smaller populations, particularly, are also recommended.** Options identified for further consideration are the purchase of easements on private lands, timberland exchanges, and cooperative agreements to protect or expand areas of suitable RCW habitat.

Increasing evidence suggests that disturbances around colonies during the breeding season causes detrimental impacts to the RCW, and that similar activity during another period has little demonstrated impact. As such, **participants recommend that policies be adopted to control or curtail activities around active colonies during the breeding season.** (See Attachment A for an action plan summary.)

Points of Consensus - Emergency Action Plan for Sensitive Populations

1. An emergency plan for stopping the decline of small and sensitive colonies or populations is needed.

2. An assessment of how many RCWs are in this situation, and the size and locations of such populations is needed.

3. Implement mid-story and under-story control practices around all active colonies.

4. Repair cavities or use restrictors as necessary.

5. Construct artificial cavities in colony sites or potential colony sites.

6. Implement an augmentation program.

7. Use state-of-the-art SPB suppression techniques to protect cavity tress.

8. Implement a detailed monitoring program as part of the emergency action plan.

9. Where acceptable habitat remains, every effort should be given to recovering abandoned sites.

10. Implement policies to protect relicts and old pine stands.

11. Continue and promote the general objectives of the interim guidelines regarding cutting for declining and sensitive populations.

12. Provide incentives to ensure implementation.

13. Increase enforcement of existing regulations.

14. Increase educational opportunities for field personnel on implementing emergency techniques.

15. Conduct detailed inventories of RCW populations on both public and private lands to validate trends.

16. Enact polices that encourage the maintenance of corridors to protect or create linkages, particularly between smaller populations.

17. Enact policies that control or curtail activities around active colonies during the breeding season.

IX. Recommended Policy Initiatives

Although the Summit was primarily intended to focus on the biological needs of the RCW, and associated management practices, participants expressed the need to address policy issues as well. To reinforce the importance of policies which actively manage for both the immediate and long-term needs of the RCW, participants discussed policy recommendations designed to change the way in which the RCW is managed.

Areawide Management

Currently, management practices for the RCW center on managing the area contiguous to colony sites. **Participants suggest that a broader approach to managing the RCW is needed for achieve both the short-term and long-term needs of the woodpecker: areawide management.** In this scheme, large areas of existing and potential habitat, and connecting systems, would be managed more holistically. Desirable population sizes and locational boundaries of those populations would be established along with the acreage required for that population. Areawide management would be conducted in areas of identified suitable habitat for the RCW. Another recommendation associated with areawide management is the **establishment of an area within a national forest where timber harvesting would be limited to be consistent with the management objectives for the RCW.** For example, areas in the heart of the 15 target populations might be excluded from the harvest inventory. Other resources would benefit from this approach and, perhaps, this system would eventually provide the timber industry with a scarce resource, large, old growth trees.

To thoroughly examine an areawide management approach, **the need for a pilot research project was identified.** Although research is needed in more than pine forest type, a **longleaf pine system in Florida, the Clearlake Wilderness Study Area, was suggested as a good candidate for the pilot study.** This is a wilderness study area of about 10,000 acres which could be used to help test a working hypothesis, profile an old growth forest, and examine an alternative to existing management techniques. It was noted that any management system experiment which would potentially affect RCW colonies needs to be consistent with endangered species regulations.

Implementation of the Recovery Plan

The debate over whether the Recovery Plan is adequate to promote the long-term recovery of the RCW is of little importance until it has been properly and fully applied to several different situations. As such, participants agree on two issues pertaining to the Recovery Plan:

1. **The Recovery Plan should be modified as suggested in this report to incorporate new data and information on population dynamics, nesting and foraging.**

2. **The Recovery Plan should be funded at the level necessary to fully implement the Plan on management units throughout the range of the RCW.**

More generally, policies should be initiated to assure the occurrence and continuity of old trees in RCW habitat. Guidelines should be specific enough to provide managers with sound guidelines and objectives, but should not be seen or implemented as a cookbook. Educational initiatives in concert with new policy directives are necessary. Increased efforts of both public managers and experts on the RCW are needed to enhance and coordinate recovery planning and implementation.

Participants also addressed the perceived lack of coordination and mutual support among agencies and organizations attempting to manage for the recovers of the RCW. Improved coordination between agencies and organizations was suggested, as well as between agency administrative and field personnel. Improved enforcement of existing regulations governing protected species was also suggested.

Technical Advisory Committee

Participants recommend a Technical Advisory Committee be formed of selected experts in different fields of RCW study to assist the Forest Service and/or the Fish and Wildlife Service. This Committee would provide ongoing assistance on issues crucial to the survival of the RCW. The Committee could be a resource in the preparation of the EIS, developing a research agenda, evaluating the implementation of the Recovery Plan or other efforts (such as the emergency action plan for sensitive and declining populations). If administrative procedures limit the formation or role of such a body, the role of the Committee can be integrated into activities such as scoping and public involvement.

Points of Consensus - Policy Initiatives

1. A broader approach to managing the RCW is needed for achieve both the short-term and long-term needs of the woodpecker: areawide management.

2. A consideration for areawide management is the establishment of an area within national forests where timber harvesting would be limited to be consistent with the management objectives for the RCW.

3. To thoroughly examine an areawide management approach, a pilot research project is needed.

4. Although research is needed in more than pine forest type, a longleaf pine system in Florida, the Clearlake Wilderness Study Area, is suggested as a good candidate for the pilot study.

5. The Recovery Plan should be modified as suggested in this report to incorporate new data and information on population dynamics, nesting and foraging.

6. The Recovery Plan should be funded at the level necessary to fully implement the Plan on management units throughout the range of the RCW.

7. A Technical Advisory Committee should be formed of experts in different fields of RCW study to assist the Forest Service and/or the Fish and Wildlife Service.

X. Recommended Research Initiatives

Discussions of research needs were addressed throughout the Summit. Numerous research topics were suggested by participants as necessary for improved management of the RCW. Some points of agreement (as indicated in this summary) carried the caveat "based on available data". As such, research on the RCW and associated management practices are acknowledged as important to the recovery of the RCW.

The following research initiatives are recommended:

Population Dynamics

1. Survey populations and habitat on private lands near marginal/sensitive populations; maybe near larger populations as well.

2. Determine whether the RCW will use corridors for moving from one area to another and for colonies sites.

3. Determine whether the RCW will cross barriers of 5 miles.

4. Ascertain what constitutes an effective barrier.

5. Examine the dynamics of small/isolated groups, including regional variation and demographic characteristics.

6. Collect data to verify basis for: 400 breeding pairs; minimum number of populations needed for recovery; viability assessment, including environmental, demographic and genetic characteristics.

7. Examine effects of competition on reproductive success.

8. Evaluate the impact of flying squirrels' breeding cycle and other competitors on the RCW.

9. Assess the characteristics of effective dispersal; modeling may be an important component of such assessments.

10. Monitor and analyze colony failures to gain greater understanding of dynamics.

11. Examine the survival probability of various population sizes as a function of isolation, habitat and management potential.

12. Analyze survival probabilities of different stands being impacted by catastrophic events - generate from existing data (forest inventory).

13. Conduct a detailed survey of population size.

Nesting

1. Study the effects of disturbance on the RCW - such as noise and physical disturbance - and the timing, frequency and duration of such disturbances.

2. Collect and evaluate information on methods of protecting RCW cavity trees from bark beetles.

3. Assess the effectiveness of artificial cavities on actually increasing RCW habitat.

4. Determine the feasibility and impacts of RCW translocation to unoccupied suitable habitat.

Foraging

1. Examine regional differences in the quality of foraging habitat, including substrate and relative abundance of prey.

2. Develop a greater understanding of prey base on the dynamics of foraging.

3. Collect more information on the impacts of hardwood removal as it affects foraging.

Integrated Management

1. Collect more information on the impacts of converting even aged to uneven aged stands.

2. Collect more information on how to manage the RCW in urbanizing areas.

3. Conduct more research on shortleaf and loblolly systems, since most information exists for longleaf systems; this research should incorporate a comparative analysis of characteristics being examined with those of longleaf forests.

4. Design and conduct research on the use of an areawide approach to managing the RCW, including an assessment of ecosystem management techniques on different forest types.

XI. Next Steps

The Summit provided an opportunity for participants to address a variety of issues pertaining to the biological needs and management of the red-cockaded woodpecker. A significant portion of time was allocated to discussing policy initiatives, based on the biological needs of the RCW, which could help reverse the decline of the species and the habitat it occupies.

Attachment A is an action plan outline which was distributed to Summit participants. The action plan is meant to serve as a guide for implementing one of the major recommendations of the Summit; development and implementation of an emergency plan for reversing the decline of small and sensitive populations. Unfortunately, time was not sufficient for participants to complete the plan.

Some participants suggested a follow-up meeting should be convened to continue some of the discussions initiated at the Summit. Developing an action plan such as the one attached could be an important "next step" to carrying forth the work begun at the Summit. Several other issues could also be addressed by an additional meeting, such as the actions steps and responsibilities necessary to implement other policy and management initiatives discussed. In the absence of another meeting, the attached action plan provides the framework for identifying tasks necessary to move the issues forward.

XII. List of Participants

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XIII. List of Funders and Copyright Information

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Mary Reynolds Babcock Foundation

George N. Bullard Foundation

Patagonia Incorporated

 Information about the Summit can be obtained from the National Wildlife Federation, 1718 Peachtree Street, Suite 592, Atlanta, Georgia, 30309. 404/876-8733.

APPENDIX H

ENDANGERED SPECIES ACT
SECTION 7 CONSULTATION

United States Department of Agriculture | Forest Service | Southern Region | 1720 Peachtree Road, NW Atlanta, Georgia 30367

Reply to: 2670

Date: September 2, 1994

James W. Pulliam, Jr., Regional Director
USDI, Fish and Wildlife Service
1875 Century Boulevard
Atlanta, GA 30345

Dear Jim:

We are requesting initiation of formal consultation on our proposed red-cockaded woodpecker (RCW) management strategy, as documented in the enclosed Biological Assessment. The Biological Assessment is strictly a disclosure of biological effects and is not a decision document. The Biological Assessment, your Biological Opinion, and the documentation in the Environmental Impact Statement (EIS) will be used by the Regional Forester to make the final decision, which will be documented in a Record of Decision. Our proposed action is identified as alternative E in the EIS. However, based on your Biological Opinion, this alternative or others may be modified and considered. The EIS will be a regional programmatic document disclosing general effects. Further analysis to incorporate this strategy into each Forest Plan will be done by each affected National Forest. The analysis will be documented in Forest Plan Amendments or Revisions, which will undergo formal consultation as part of the process. In addition, section 7 consultation will be done on site specific projects that effect RCW.

In addition to the Biological Opinion, we are requesting that you concur with our determinations of effect for the other four alternatives considered in the EIS. Part of the RCW management strategy allows installation of cavity restrictors and artificial cavities, as well as individual RCW to be translocated. Translocation involves the capture, banding, transportation and release of individuals. Although mortality of individuals is not expected from these activities, there is a remote possibility that harm could occur. The FWS has authorized translocation activities, including take, under our RCW endangered species permits SA 94-42 and PRT-676811. We want to be sure that these activities, including take, are addressed in the Biological Opinion for our proposed action.

Richard Hannan of your staff has indicated that a FWS team will be put together to prepare the Biological Opinion. We would like to present a briefing to the team as early in the consultation process as is convenient. We believe a briefing will help the team better understand the five alternatives in the EIS and may help expedite the process. If you have any questions regarding the

enclosed Biological Assessment or need additional information, please contact Dennis Krusac, Red-cockaded woodpecker EIS Team Leader at 347-4338. We will continue to work with you as we all strive to recover the red-cockaded woodpecker.

Sincerely,

Gloria Manning

for ROBERT C. JOSLIN
Regional Forester

Enclosure

BIOLOGICAL ASSESSMENT
USDA FOREST SERVICE, SOUTHERN REGION
MANAGEMENT OF THE RED-COCKADED WOODPECKER AND ITS HABITAT ON NATIONAL FORESTS IN THE SOUTHERN REGION

INTRODUCTION

This biological assessment is regional in scope and will determine if the five alternatives developed for management of the red-cockaded woodpecker (RCW) and its habitat would likely adversely affect threatened or endangered species. Currently, there are no species proposed for listing that occur in RCW habitats. Recent RCW surveys indicated a decline in the number of active clusters for most RCW populations (Costa and Escano 1989). Most of these populations are small (< 50 active clusters) and have a high risk of extirpation. Primary causes of the declines in most populations include mid-story encroachment in cluster sites, lack of potential cavity trees, cavity competition, loss of cavity trees, habitat fragmentation, and demographic isolation.

The results of the Costa-Escano Report (1989) indicating declines in most RCW populations, the legal precedent set by the litigation in Texas, and continuous improvement in our knowledge and understanding of the RCW led to the decision to develop new regional management direction for recovery of the species. The Regional Forester decided immediate action was needed to stabilize existing RCW populations, in addition to the development of a new RCW management strategy. The Regional Forester established a three phase process to meet these goals.

Phase one was an immediate action that established a policy on cutting within 3/4 mile of RCW clusters on existing timber sale contracts (March 27 Policy). This policy halted or modified proposed, advertised, or active timber sales within 3/4 mile of RCW clusters. Phase two was the development of interim standards and guidelines for the management of RCW habitat within 3/4 mile of cluster sites. All National Forests in the Southern Region with RCWs, except the National Forests in Texas, have been operating under interim RCW management direction since 1991. The National Forests in Texas are operating under a court ordered RCW management plan. As the name implies, interim direction was designed to be a transitional management strategy. The intent of interim standards and guidelines was to stop or slow the rate of RCW population declines while long-range RCW management direction was being developed. Phase three of the process is the development of the long-range RCW management strategy, which will be documented in an Environmental Impact Statement (EIS) and Record of Decision (ROD). This biological assessment analyzes the five alternatives developed for management of the RCW and its habitat, as disclosed in the draft EIS. This document is regional in scope and covers RCW habitats on National Forests in Kentucky, Tennessee, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas, and Texas.

BIOLOGICAL BACKGROUND

There are 29 threatened or endangered species associated with RCW habitats. These species include those that occur or are likely to occur in RCW habitats or micro-habitats within RCW habitats and those species that currently do not occur on National Forests, but which have suitable habitat available, such as the red wolf (Canus rufus). The species potentially effected and their status are listed in Table 1.

TABLE 1. Threatened or Endangered species known to occur or likely to occur in RCW habitats or micro-habitats within RCW habitat.

Common Name	Scientific Name	Federal Status
PLANTS		
PIGEON WINGS	Clitoria fragrans	T
APALACHICOLA ROSEMARY	Conradina glabra	E
SCRUB BUCKWHEAT	Eriogonum longifolium var. gnaphalifolium	T
HARPER'S BEAUTY	Harperocallis flava	E
PONDBERRY	Lindera melissifolia	E
ROUGH-LEAVED LOOSESTRIFE	Lysimachia asperifolia	E
WHITE BIRDS-IN-A-NEST	Macbridia alba	T
BRITTON'S BEARGRASS	Nolina brittoniana	E
GODFREY'S BUTTERWORT	Pinguicula ionantha	T
SMALL LEWTON'S POLYGALA	Polygala lewtonii	E
CHAFFSEED	Schwalbea americana	E
FLORIDA SKULLCAP	Scutellaria floridana	T
NAVASOTA LADIES'-TRESSES	Spiranthes parksii	E
MAMMALS		
RED WOLF	Canus rufus	E
FLORIDA PANTHER	Felis concolor coryi	E
EASTERN COUGAR	Felis concolor couguar	E
GRAY BAT	Myotis grisescens	E
INDIANA BAT	Myotis sodalis	E
VIRGINIA BIG-EARED BAT	Plecotus townsendii virginianus	E
LOUISIANA BLACK BEAR	Ursus americanus luteolus	T
BIRDS		
PEREGRINE FALCON	Falco peregrinus	E
MISSISSIPPI SANDHILL CRANE	Grus canadensis pulla	E
BALD EAGLE	Haliaeetus l. leucocephalas	T
RED-COCKADED WOODPECKER	Picoides borealis	E
REPTILES		
EASTERN INDIGO SNAKE	Drymarchon carais couperi	T
BLUE-TAILED MOLE SKINK	Eumeces egregius lividus	T
GOPHER TORTOISE	Gopherus polyphemus	T
SAND SKINK	Neoseps reynoldsi	T
INSECTS		
AMERICAN BURYING BEETLE	Nicrophorus americanus	E

RED-COCKADED WOODPECKER

The RCW is endemic to the pine forests of the southern United States. It is found from Texas to the Carolinas. The species is non-migratory and groups maintain year-round territories near their nesting and roost trees. One of the more unique features of the RCW's life history is its selection of mature, living pines for cavity excavation. It is the only woodpecker species to excavate a nesting cavity in living pine trees exclusively. Most active clusters are found in open, park-like pine stands. RCW exhibit a distinct preference for living pine for foraging as well. For a more detailed description of the RCW and its ecology see the RCW Recovery Plan (USDI 1985).

Seven national forest populations are on the verge of extirpation, with five or less active clusters known to exist in each population. Seventy percent of RCW populations occurring on national forests currently have less than 50 active clusters (Table 2). These small populations are more vulnerable to extinction from demographic and stochastic events (Shaffer 1981, 1987, Gilpin and Soule' 1986, Goodman 1987). The RCW has been extirpated on the Uwharrie, Sumter, Tuskegee, and Tombigbee National Forests, and the Caney Ranger District of the Kisatchie National Forest.

Because of the lack of repeat population estimate surveys, RCW population trend interpretations are difficult. The only information readily available for trend analysis is the annual surveys conducted to determine the status of known clusters. A certain number of clusters are visited annually--the number varies by year and Forest. The percent of those clusters visited that are active, plotted by year is the best data currently available from which to interpret trends.

Surveys based on visits to known clusters only, as opposed to systematic area searches, have two opposing biases. They tend to overestimate the number of inactive clusters and, due to the tendency to select previously active clusters for survey, also overestimate the percent of active clusters in the sample. Being aware of the inherent bias associated with this type of survey at least allows a more realistic interpretation of the data. Even with allowance for the bias, survey data from 1970-86 indicate that most of the smaller RCW populations were decreasing (Costa & Escano 1989). Analysis of the cluster status check data for 1987 through 1993 has not changed these interpretations greatly. Most small populations are still decreasing, but the rate of decline has slowed for most populations.

Several factors have probably contributed to the current status and trends of RCW populations. Generally, RCW population expansion is limited by existing forest age class distribution. In many forests the majority of nesting habitat is in older aged relict trees. Many of these old trees have been lost to natural mortality and timber management practices. If availability of suitable cavity trees from increasing stand age is not adequate to offset this loss, decreases in RCW populations are possible. Even though stand age is increasing in most forests with RCWs, increases in suitable nesting habitat are not likely to offset cavity mortality for at least 10 years. In over half the forests, high quality potential cavity trees will not be available for another 20 to 40 years.

Rapid population declines in some RCW populations are due to hardwood mid-story encroachment (Hopkins and Lynn 1971, Van Balen and Doerr 1978, Locke et al. 1983, Hovis and Labisky 1985, Conner and Rudolph 1989). This condition in clusters increases competition for RCW cavities by other species as well as creating a favorable environment for nest predation (Loeb 1993). Conversely, in forests with a history of prescribed burning and, therefore, no mid-story problem, healthy RCW populations are present. Slow RCW population declines on such forests can probably be attributed to natural mortality of cavity trees and the nesting habitat bottleneck previously discussed. On forests where availability of suitable cavity trees is not limiting, mid-story control should favor population increases even during the bottleneck period.

Table 2
National Forests with tentative HMAs, existing RCW populations, and tentative population objectives.

STATE	National Forests with HMAs (RECOVERY POP. UND)	Population 1993	Tentative Pop. Objective
		(Active Clusters)	
ALABAMA	Bankhead	1	68
	Conecuh	12	309
	Talladega-Oakmulgee Rd	132	394
	Talladega/Shoal Creek Rd	5	413
		150	1,184
ARKANSAS	Ouachita	15	228
FLORIDA	Apalachicola-		
	Apalachicola RD	494	706*
	Wakulla RD	150	722*
	Ocala	10	242
	Osceola	43	462
		697	2,187
GEORGIA	Oconee/Hitchiti **	15	176**
KENTUCKY	Daniel Boone	5	66
LOUISIANA	Kisatchie-		
	Catahoula RD	27	328
	Evangeline RD	48	231
	Kisatchie RD	66	296
	Vernon RD	186	321
	Winn RD	21	281
		348	1,457
MISSISSIPPI	Bienville	90	500
	DeSoto-		
	Biloxi RD	3	191
	Black Creek RD	1	62
	Chickasawhay RD	2	502
	Homochitto	24	175
		119	1,430
N.CAROLINA	Croatan	54	139
S.CAROLINA	Francis Marion	355	809*
TENNESSEE	Cherokee	1	n/a
TEXAS***	Angelina/Sabine	41	329
	Davy Crockett	37	36
	Sam Houston	139	525
		217	1,179
SOUTHERN REGION		1,976	9,300

* These populations can be declared recovered (MIL1) when they reach 500 active clusters and meet all other criteria needed for recovery.

** The Oconee NF is combined with Hitchiti Experimental Forest and Piedmont National Wildlife Refuge by Memorandum of Understanding (FSM 2609.23). The figures listed, however, show only the Forest Service acreage and population objectives.

*** The National Forests in Texas are currently managed under a court order, which will remain in effect until different management direction is approved by the District Court.

Genetic and demographic factors further compromise the health of small RCW populations. Undoubtedly, there exist a minimum population level even with acceptable habitat conditions at which populations may be lost.

Rangewide, population fragmentation continues to be a serious problem. Approximately 80 percent of the RCW populations on FS lands are more than 50 miles apart. Frequently the habitat between populations is not contiguous forested acreage and is often in private ownership. Several RCW populations known to exist in the 1970's, are gone. Population fragmentation could have contributed to their decline and disappearance. These populations were small (less than 25 known clusters) and most clusters exhibited significant hardwood encroachment. The remaining small, isolated populations exhibiting population declines are prime candidates for extirpation and therefore must be the focus for renewed conservation efforts. The majority of FS populations fit this category, with 70 percent of them having less than 50 active clusters.

OTHER THREATENED OR ENDANGERED SPECIES

PLANTS

There are thirteen threatened or endangered species of plants that could potentially be effected by the five proposed RCW management alternatives. These species are identified in Table 1. A brief description of each species follows, with emphasis on known locations, preferred habitats, and primary reasons for decline.

Pigeon wings, a member of the pea family, is found in Highlands, Polk, Lake, and Osceola Counties, Florida. This species inhabits sand pine scrub vegetation, turkey oak barrens, and longleaf pine sandhills. Although this species is not currently known to exist on National Forest lands, suitable habitat does exist. Primary causes of population declines include habitat loss due to agricultural and residential development, habitat fragmentation, and fire suppression (Federal Register Vol. 58(79): 25746-25755).

Apalchicola rosemary is known to exist only in Liberty County, Florida and is threatened by habitat modification. The species is associated with longleaf pine-wiregrass communities and prefers open conditions (Federal Register 1993 Vol. 58(131): 37432-37434). The species is not shade tolerant and its association with longleaf pine-wiregrass communities strongly suggest a need for frequent fires to perpetuate this species.

Scrub buckwheat is a perennial herb that occurs in the Ocala National Forest. This species occurs in habitats intermediate between scrub and sandhills, and in turkey oak barrens. Primary causes for population declines include agricultural and residential development, habitat fragmentation, and fire suppression (Federal Register Vol. 58(79): 25746-25755).

Harper's Beauty is known from 3 locations, 1 in Franklin County and 2 in Liberty County, Florida. All sites are within the Apalachicola National Forest. This species occurs in open bogs and is most prolific in full sun. All known locations are along roads. Major threats to this species include collection and bog succession. Prescribed burning should maintain the open conditions this species needs (USDI 1983).

Pondberry is currently known from Arkansas (10 populations), Georgia (4 populations), Mississippi (13 populations), Missouri (1 population), North Carolina (3 populations), and South Carolina (5 populations). The species may have been extirpated from Florida, Louisiana, and Alabama. The species occurs in seasonally flooded wetlands, sandy sinks, pond margins, limestone sinks, and wet depressions in longleaf pine flatwoods. Major reasons for decline include habitat alteration or destruction through land clearing, drainage modification, or timber harvesting. Pondberry appears to do best under a closed canopy and tree removal may be detrimental to the species (USDI 1992). Activities that could affect hydrology, including fire control plowlines, may have adverse effects on pondberry. There is also an apparent lack of seedling establishment in the wild. Some experimental propagation work has been successful in the Francis Marion National Forest Seed Orchard (Ollie Buckle personal communication 1993).

Rough-leaved loosestrife is currently known from nine locations in North Carolina and is believed extirpated in South Carolina. The perennial herb generally occurs in transition zones between longleaf pine uplands and pond pine pocosins, but has also been found in Carolina bays. Primary reasons for endangerment include fire suppression, drainage associated with silviculture and agriculture, and residential and industrial development (Federal Register Vol. 52(113): 22585-22589).

White birds-in-a-nest occurs in Bay, Gulf, Franklin, and Liberty Counties, Florida. The Apalachicola National Forest has 41 of the 63 known sites for this species. White birds-in-a-nest occur in grassy seepage bogs, savannahs, and longleaf pine flatwoods. Major threats to this species include intensive site preparation and planting of savannahs, drainage modification and fire suppression (Federal Register Vol. 55(243): 51936-51940).

Britton's beargrass is known to occur in Highlands, Polk, Orange, Osceola, and Lake Counties, Florida. This species inhabits scrub, sandhills, and occasionally hammocks. This species is not currently known to exist on National Forest lands, but suitable habitat may exist on the Ocala National Forest. Major causes of population declines include agricultural and residential development, habitat fragmentation, and fire suppression (Federal Register Vol. 58(79): 25746-25755).

Godfrey's butterwort is a carnivorous plant of the bladderwort family, and is shade intolerant. This species occurs in Bay, Gulf, Franklin, and Liberty Counties, Florida including the Apalachicola National Forest. Godfrey's butterwort inhabits seepage bogs on gentle slopes, deep quagmire bogs, ditches, and depressions in grassy pine flatwoods and savannahs. Major threats to this species include intensive site preparation and planting, drainage modification including plowed fire lines, and fire suppression and the associated titi encroachment (Federal Register 58(131): 37432-37443).

Small Lewton's Polygala occurs in Highlands, Polk, Osceola, Lake, and Marion Counties, Florida and is known to occur in the Ocala National Forest. The species inhabits scrub vegetation and longleaf pine sandhills. Major threats to this species include agricultural and residential development, habitat fragmentation, and fire suppression (Federal Register 58(79): 25746-25755).

Twenty extant populations of American chaffseed are found in Florida, Georgia, Mississippi, New Jersey, North Carolina, and South Carolina. The species has been extirpated from Alabama, Connecticut, Delaware, Kentucky, Maryland, Massachusetts, New York, Tennessee, and Virginia. American chaffseed inhabits open, moist pine flatwoods, savannahs, and transition zones between peaty wetlands and xeric sandy soils. The species appears to be shade intolerant. The primary reasons for population declines include habitat destruction due to development and fire suppression (Federal Register 57(189): 44703-44708).

Florida skullcap is a perennial herb known to occur in Gulf, Franklin, and Liberty Counties, Florida, including 6 sites in the Apalachicola National Forest. This species inhabits grassy seepage bogs, savannahs, and transitions zones between longleaf pine flatwoods and wetter habitats. Major threats to this species include intensive site preparation and planting of savannahs, drainage modification, and fire suppression (Federal Register Vol. 55(243): 51936-51940).

Navasota ladies'-tresses is known from only a few locations in Brazos County, Texas and one location in the Angelina National Forest. Fire suppression has affected this species (Federal Register Vol. 45(119): 41326-41328). This species is associated with post oak flats and should not be effected by RCW management.

MAMMALS

Of the seven species of mammals included in table 1, the red wolf, Florida panther, and eastern cougar are not currently known to exist on National Forest lands. However, suitable habitat for these species does occur and therefore potential effects must be disclosed. Primary reasons for endangerment include habitat loss, habitat fragmentation, and direct mortality from shooting or road kills (Federal Register 1992; USDI 1982a, 1987, 1989).

Gray bat, Indiana bat, and Virginia big-eared bat may occur on National Forests with RCWs and could utilize similar habitats for foraging or fly through these habitats on their way to preferred foraging areas along waterways. Primary causes of population declines in these bats are human disturbance and pesticides (USDI 1982b, 1983b, 1984).

The historical range of the Louisiana black bear included eastern Texas, Louisiana, and southern Mississippi. The Louisiana black bear is known to exist on the De Soto National Forest and may exist on the Homochitto National Forest. Both of these forests are in southern Mississippi. Reasons for listing include habitat loss and direct mortality from shooting (Federal Register Vol. 57(4):588-595).

BIRDS

Nesting habitat for the peregrine falcon may occur on the Daniel Boone National Forest. Many southern national forests occur within known migration corridors of wintering peregrine falcons. Forests with RCWs may provide wintering habitat for falcons. Pesticides and shooting are the primary reasons for peregrine falcon population declines in the past (USDI 1979).

The Mississippi sandhill crane's range is limited to Jackson County, Mississippi, including portions of the De Soto National Forest. The preferred habitat is wet pine savannahs and open pine forests. There is potential for RCW management to effect crane habitat. Primary reasons for declines of Mississippi sandhill crane include habitat loss and modification caused by drainage, intensive site preparation and planting, and fire suppression (USDI 1990a).

The bald eagle is found throughout the southeast. Nesting is limited primarily to peninsular Florida and to a much lesser extent the coastal areas and areas around large impoundments in Louisiana, Mississippi, South Carolina and Texas. Nesting habitat is generally associated with large bodies of water. The potential does exist for RCW management to occur in active or potential eagle nesting habitat. Habitat loss, fragmentation, and pesticides are the primary reasons for bald eagle population declines (USDI 1983c).

REPTILES

The eastern indigo snake was historically found from extreme southeastern South Carolina, the coastal plains of Georgia, throughout Florida, southern Alabama and Mississippi. Currently the species is known to occur in Florida and Georgia. A reintroduction was made on the De Soto NF In Mississippi, however, its success or failure is unknown. Eastern indigo snakes occur in RCW habitat. They are closely associated with gopher tortoise burrows. Preferred habitats include open pine forests in flatwoods, dry glades, and sandhills. This species is often associated with longleaf pine - turkey oak forest types. Habitat loss and degradation caused by development, fire control, and hardwood encroachment, as well as collecting for the pet trade, are the primary reasons for population declines of the eastern indigo snake (USDI 1982c). In one study, 94% of wintering eastern indigo snakes were located in gopher tortoise burrows, so a decrease in gopher tortoise population could also affect eastern indigo snake abundance.

The blue-tailed mole skink is known only from Polk, Highlands, and Osceola Counties, Florida. This species is not known to occur on National Forest lands, but uses habitats similar to the sand skink which occurs on the Ocala National Forest. Suitable habitat includes sand pine scrub and longleaf pine-turkey oak communities. Primary reasons for decline include habitat loss due to agricultural and residential development (Federal Register Vol. 58(87): 27307-27308).

The gopher tortoise is found in xeric sandy habitats from South Carolina through Florida and west to extreme southeastern Louisiana. This species is listed as threatened in Louisiana, Mississippi and west of the Tombigbee and Mobile Rivers in Alabama, and is a candidate for listing in the rest of its range. The range of the gopher tortoise nearly coincides with the original range of longleaf pine. Suitable gopher tortoise habitat includes well-drained sandy soils, an abundance of herbaceous ground cover, and an open forest canopy with sparse shrub cover. Major causes of population declines include habitat loss, fragmentation, fire suppression, and predation including humans capturing them for food (USDI 1990b).

The sand skink occurs in Highlands, Polk, Osceola, Orange, Lake, and Marion Counties, Florida, including the Ocala National Forest. Suitable habitat includes sand pine scrub and longleaf pine-turkey oak communities. Primary reasons for decline include habitat loss due to agricultural and residential development (Federal Register Vol. 58(87): 27307-27308).

The American burying beetle historically occurred throughout temperate Eastern North America. Currently this species is only known to exist in Rhode Island, Arkansas, Oklahoma, and Nebraska. The Ouachita National Forest is the only forest with RCWs that also has known populations of American burying beetle. The broad geographic range of this species indicates there is no preference for a particular habitat type. Soils that are unsuitable for carcass burial (very xeric, saturated, or loose sandy soil) are probably avoided. Carrion availability appears to be more important than vegetation or soil type. The cause of the wide-spread population decline is unknown (USDI 1991).

THE PROPOSED ACTION

The Forest Service proposes to revise the Regional Wildlife Habitat Management Handbook, amend the Southern Regional Guide, and amend affected Forest Plans with new management direction for the endangered red-cockaded woodpecker. The proposed action has several elements and levels of implementation. The revised Handbook/Regional Guide Amendment (Revised Handbook) would establish criteria to delineate RCW Habitat Management Areas (HMAs) and determine population objectives and establish standards and guidelines for management within HMAs. This direction would be implemented on each affected forest when incorporated in the Forest Plan by amendment or revision.

Because of the time lag between the Handbook revision/Regional Guide amendment and the individual Forest Plan amendments or revisions, the Forest Service also proposes to amend the relevant Forest Plans to designate tentative HMAs in the Record of Decision (ROD) to follow this EIS. The Forest Plan amendments designating tentative HMAs would require specific management practices to conserve the RCW and avoid jeopardy to the species, and would remain in place until superseded by the individual Forest Plan amendments or revisions to incorporate the revised Handbook/Regional Guide direction.

The proposed Regional direction has two primary purposes: (1) Protect RCWs and their habitat so existing populations may be conserved and, (2) Improve habitat throughout identified HMAs to assure recovery of the species on National Forest System lands. We propose to manage RCW populations and habitat so that: (1) 12 recovery populations increase to or beyond 400 potential breeding pairs (if the land base allows) and, (2) 14 RCW support populations increase to or beyond 40 potential breeding pairs.

The Forest Service has formally adopted a policy of ecosystem management. Accordingly, National Forest and Grasslands will be managed based on ecological principals in such a way as to provide for the needs of people and to ensure the sustainability, productivity, and diversity of ecosystems. The proposed action must be consistent with this approach. We developed and evaluated alternative proposals with due consideration of what is known of the biology and ecology of the RCW, and what is known about the structure and function of the ecosystems in which it evolved.

A variety of ecosystems are included within the tentative HMAs. For this regional analysis it was necessary to focus on those aspects of ecosystem structure, composition, and function that were similar in all the various ecosystems. Unifying ecosystem traits included: (1) the dominance or shared dominance of a pine species that is tolerant of fire (at least after it has attained some minimum size), (2) sparse to absent midstory, (3) a primarily herbaceous ground layer on many sites, and (4) the recurrence of fire as a disturbance process. Although these traits varied somewhat, they were considered to be generally applicable throughout the HMAs and were accepted as desirable conditions for suitable RCW habitat and subsequent recovery.

It is assumed that providing the above conditions, through a variety of management activities, will help achieve the goal of RCW recovery and follows ecological principles. However, in the short-term (10-20 years), these efforts cannot restore the ecosystems as they occurred prior to European settlement. Given the existing condition of these ecosystems and the disjunct ownership patterns of Forest Service System Lands, it is doubtful if this, or any, management strategy will be capable of restoring pre-Colombian conditions in any reasonable time frame. However, the efforts outlined in the proposed action should yield ecological systems that are structured and function much more like the pre-Colombian systems than those systems in their current condition.

ELEMENTS OF THE PROPOSED ACTION AND ALTERNATIVES

The following are brief descriptions of the proposed action (Alternative E) and other alternatives being considered. Table 3 of the BA is an alternatives comparison table. For a more detailed description of the alternatives, consult Chapter 2 of the EIS.

PROPOSED ACTION (ALTERNATIVE E)

The Forest Service proposes to:

(1) Revise the Regional Wildlife Habitat Management Handbook, FSH 2609.23R, RCW Chapter (Handbook) to establish new Regional Direction for the management of the red-cockaded woodpecker and its habitat and amend the Southern Regional Guide to incorporate the revised chapter. The Revised Handbook would:

- Establish criteria to delineate RCW HMAs.
- Determine population objectives that ensure demographic stability.
- Establish four Management Intensity Levels (MILs) which are based on the risk of extirpation (local extinction) faced by the RCW population in the HMA. The risk categories are determined based on population size and trend. This "variable assist" approach to RCW recovery increases the level of habitat protection and management for high-risk populations.
- Emphasize the use of artificial cavities and the moving of RCW from area to area (translocation) to speed population expansion and recovery of the species.
- Establish minimum rotation lengths ranging from 70 to 120 years depending on the species of pine being managed in stands managed with even-aged and two-aged regeneration methods. Establish maximum diameter limits based on pine species and site quality for stands managed with uneven-aged regeneration methods. Habitat Management Areas would produce woodpecker habitat and timber products on a sustained-yield basis.
- Emphasize thinning to reduce southern pine beetle risk and enhance RCW habitat.
- Emphasize prescribed fire, including growing season burns, to control midstory vegetation in the pine and pine-hardwood forest types throughout HMAs, especially within clusters.
- Establish criteria to assure adequate foraging habitat (6350 pine trees greater than 10" diameter, 25 years old or older within 1/2 mile of and connected to the clusters.)
- Permit a wide range of regeneration methods. Use of various silvicultural practices would be based on balancing current RCW habitat needs with existing stand condition, site quality, and regeneration of the forest which will provide future habitat.
- Limit regeneration of the oldest 1/3 of pine and pine-hardwood acres until rotation age. This will ensure suitable potential cavity trees in the shortest time.
- Encourage restoration of longleaf and other desirable pine species in areas where they occurred historically and would provide better habitat for the RCW.
- Establish monitoring requirements to determine if the objectives of the new RCW management direction are being met.
- Require monitoring intensity be linked to population size and vulnerability of the RCW population.

- Include implementation (quality control), effectiveness (systems control), and policy validation (mission control) monitoring.

(2) Immediately amend 11 Forest Plans through the Record of Decision (ROD) to identify and delineate tentative RCW Habitat Management Areas (HMA) totaling approximately 2 million acres. The affected National Forests where RCW occur are: Alabama, Chattahoochee-Oconee, Cherokee, Daniel Boone, Croatan and Uwharrie, Florida, Francis Marion, Kisatchie, Mississippi, Ouachita, and Texas. The ROD would also establish an implementation time line for the national forests to amend or revise their Forest Plans to incorporate the specific elements of the Revised Handbook.

Tentative HMAs would include suitable RCW habitat between the 3/4-mile radius circles around active and inactive clusters currently protected by Interim S&Gs. The Interim S&Gs will remain in effect within the 3/4-mile radius circles until individual Forest Plans are amended/revised to incorporate the Revised Handbook, one to three years.

Within the tentative HMAs, but outside the 3/4-mile radius circles, current Forest Plan standards and guidelines will remain in effect, except only the following silvicultural systems and practices will be allowed:

- Thinning.
- Irregular shelterwood method (two-aged).
- Single-tree and group selection methods (uneven-aged).
- Clearcutting method (even-aged) would be allowed to restore longleaf, shortleaf, or other desirable native pine species to appropriate sites currently occupied by trees less suitable for the RCW. This would require a site-specific environmental analysis showing no detrimental effect to the RCW.

The tentative HMAs and accompanying direction will remain in place until individual Forest Plans are amended/revised to incorporate the Revised Handbook.

Regardless of alternative selected, the National Forests In Texas present a special case, remaining under a court-ordered RCW management plan. The Forest Service submitted the Interim Standards and Guidelines for Protection and Management of RCW Habitat within 3/4 Mile of Colony Sites (Interim S&Gs) to the court for its approval, but the court has not ruled on them to date. If the court has not ruled by the time this EIS is completed, the Forest Service will submit the Revised Handbook (based on the chosen alternative) to the court. Until the court decides whether to approve a new management strategy, the court-ordered plan remains in effect.

Alternative A (No Action)

Alternative A is the Interim S&Gs, the direction currently guiding RCW management on all national forest except the National Forests in Texas. The area managed for RCW is 3/4-mile radius circles around all active and inactive clusters.

The Forest Service proposes to revise the Regional Wildlife Habitat Management Handbook, FSH 2609.23R (Handbook) and amend the Southern Regional Guide to incorporate the revised Handbook immediately after the Record of Decision. The revised Handbook would make the Interim S&Gs, the regional direction for managing the red-cockaded woodpecker and its habitat. This direction is currently being implemented under existing Forest Plans, except for the National Forests in Texas which are under a court-ordered RCW management plan.

Elements of the Proposed Handbook Revision

Alternative A would:

(1) Establish Regional Handbook direction for management of the red-cockaded woodpecker and its habitat.

- Emphasize the use of artificial cavities and the moving of RCW from area to area (translocation) to speed population expansion and eventual recovery of the species.
- Continue to manage RCW within the existing 3/4-mile radius circles around all active and inactive RCW clusters (colony sites) and establish population objectives currently in the Handbook.
- Establish sufficient recruitment stands to provide clusters to meet population objectives within existing 3/4-mile radius circles.
- Establish three different management intensity zones, a high-intensity zone surrounding the cluster for 1/4 mile and a moderate intensity zone forming a "donut" between 1/4- and 3/4-mile from each cluster. The area outside the 3/4-mile zone would be managed according to Forest Plans as amended.
- Utilize irregular shelterwood as the primary regeneration method, with even-aged management allowed in specific situations.
- Limit regeneration of the oldest 1/3 of pine and pine-hardwood acres until they are within 10-20 years of rotation age. This will ensure suitable potential cavity trees in the shortest time.
- Establish a timber rotation of 120 years for all pine species within 3/4 mile circles by allowing no more than 8.3 percent and 25 percent in the 0-10 and 0-30 age classes, respectively.
- Emphasize thinning to reduce southern pine beetle risk and enhance RCW habitat.
- Emphasize prescribed fire, including growing season burns, to control midstory vegetation in the pine and pine-hardwood forest types throughout 3/4 mile circles, especially within clusters.
- Provide adequate foraging habitat (6350 pine trees greater than 10" diameter, 30 years old or older within 1/2 mile of and connected to the clusters).
- Encourage restoration of longleaf pine in areas where it occurred historically and would provide better habitat for the RCW.

(2) Establish monitoring requirements to determine if the objectives of the new RCW management direction are being met.

- o Link monitoring intensity to the size and vulnerability of the RCW population.

IMMEDIATE ACTIONS

The Forest Service would continue to manage the national forests where the RCW lives under the Interim S&Gs, which would affect management within the 3/4-mile radius circles around active and inactive clusters. The areas outside the 3/4-mile radius circles would be managed under current Forest Land and Resources Management Plans (Forest Plans).

Alternative B

Alternative B is based on the 1985 Handbook, with modifications to include information which has become available since 1985. RCW management is concentrated on clusters, replacement, and recruitment stands. The area outside these stands would be managed using Forest Plan standards and guidelines.

The Forest Service proposes to revise the Regional Wildlife Habitat Management Handbook, FSH 2609.23R (Handbook) and the Southern Regional Guide to incorporate the revised Handbook immediately after the Record of Decision (ROD). The revised Handbook would make the Handbook consistent with decisions made since 1985, such as the Fish and Wildlife Service's "Blue Book" and the southern pine beetle Record of Decision.

Elements of the Proposed Handbook Revision

Alternative B would:

(1) Establish Regional Handbook direction for management of the red-cockaded woodpecker and its habitat.

- o Emphasize the use of artificial cavities and the moving of RCW from area to area (translocation) to speed population expansion and eventual recovery of the species.
- o Replace the delineated 3/4-mile radius circles around all active and inactive RCW clusters (colony sites) with the cluster boundaries and establish recovery population objectives to comply with the 1985 RCW Recovery Plan.
- o Establish sufficient recruitment stands to meet population objectives.
- o Utilize a wide range of regeneration methods outside the clusters, recruitment stands, and replacement stands, with silvicultural objectives taking precedence within the confines of multiple use.
- o Rotations would be governed by the Forest Plans outside cluster, recruitment stands and replacement stands.

- Emphasize thinning to reduce southern pine beetle risk and enhance RCW foraging habitat.

- Emphasize prescribed fire to control midstory vegetation in the pine and pine-hardwood forest types within clusters, recruitment stands, and replacement stands.

- Assure adequate foraging habitat (6350 pine trees greater than 10" diameter, 30 years old or older within 1/2 mile of and connected to the clusters).

- Allow restoration of longleaf and other desirable pine species in areas where they occurred historically and would provide better habitat for the RCW.

(2) Establish monitoring requirements to determine if the objectives of the new RCW management direction are being met.

IMMEDIATE ACTIONS

The Forest Service would continue to manage the national forests where the RCW lives under the Interim policy. Interim would affect management within the 3/4-mile radius circles surrounding the red-cockaded woodpecker's cavity trees until the Forest Land and Resources Management Plans (Forest Plans) are revised or amended. The areas outside the 3/4-mile radius circles would be managed under current Forest Plans.

Alternative C

Alternative C is based on the establishment of HMAs and rotation lengths ranging from 70 to 200 years, depending on tree species and site quality. Rotation length is based on the assumption that longer lived trees growing on good sites develop heartwood at a slower rate. It also establishes five MILs and stresses the use of growing season burning to control midstory vegetation.

The Forest Service would revise the Regional Wildlife Habitat Management Handbook, FSH 2609.23R (Handbook) and amend the Southern Regional Guide to incorporate the revised Handbook immediately after the Record of Decision (ROD). The revised Handbook would provide a new Regional Direction for managing red-cockaded woodpecker and its habitat. This direction would be implemented as each National Forest with RCW populations individually amend or revises its Forest Plan. This would occur within one to three years.

Elements of the Proposed Handbook Revision

Alternative C would:

(1) Establish criteria to delineate RCW Habitat Management Areas (HMAs) and determine population objectives to ensure demographic stability.

Alternative C is based on delineation of HMAs. The size of HMA would be determined by the number and distribution of existing clusters, active and inactive. Each HMA would be classified as one of five management intensity levels (MIL) based on the risk of extirpation (local extinction) faced by the RCW population in the HMA. The risk categories are determined by a population's size and trend. The smaller and more dispersed RCW populations are at greater risk and would be managed and monitored more intensively.

(2) Establish Regional Handbook direction for management of the red-cockaded woodpecker and its habitat.

- o Emphasize the use of artificial cavities and the moving of RCW from area to area (translocation) to speed population expansion and eventual recovery of the species.
- o Establish rotation age between 70 and 200 years depending on pine species and site quality. Alternative C would produce timber products and woodpecker habitat on a sustained yield basis.
- o Emphasize thinning to reduce southern pine beetle risk and enhance RCW habitat.
- o Emphasize prescribed fire, including growing season burns, to control midstory vegetation in the pine and pine-hardwood forest types throughout HMAs, especially within clusters, recruitment stands and replacement stands.
- o Provide adequate foraging habitat (6350 pine trees greater than 10" diameter, 30 years old or older within 1/2 mile of and connected to the clusters).
- o Utilize a wide range of regeneration methods, with increased use of irregular shelterwood. The use of various silvicultural practices would be based on existing stand condition, site quality, and the need to balance current RCW habitat needs with regeneration of the forest to provide future habitat.
- o Limit regeneration of the oldest 1/3 of pine and pine-hardwood acres until rotation age. This will ensure suitable potential cavity trees in the shortest time.
- o Encourage restoration of longleaf and other desirable pine species in areas where they occurred historically and would benefit the RCW.

(3) Establish monitoring requirements to determine if the objectives of the new RCW management direction are being met.

- o Link monitoring intensity to management intensity level (MIL), which reflects the size and vulnerability of the RCW population.

IMMEDIATE ACTIONS

The Forest Service would amend 11 Forest Plans immediately through the Record of Decision. The affected National Forests are: Alabama, Chattahoochee-Oconee, Cherokee, Daniel Boone, Croatan, Florida, Francis Marion, Kisatchie, Mississippi, Ouachita, and Texas.

These amendments would identify and delineate tentative HMAs. Tentative HMA delineation would follow the process used to determine permanent HMAs in the revised Regional Handbook. These procedures are described in detail in Appendix A of the EIS.

The Forest Service would allow thinning, irregular shelterwood (two-aged), single-tree and group selection (uneven-aged) methods within tentative HMAs outside the 3/4-mile radius circles.

The regeneration methods proposed will preserve future management options until the time when the new RCW regional direction can be fully implemented. Forest Plan revisions or amendments may take one to three years to complete. Interim protects 3/4-mile radius circles around existing (active and inactive) clusters. Tentative HMAs extend protection to the suitable habitat areas between clusters. The allowed regeneration methods retain relatively high basal area and canopy cover, which would allow a wide range of silvicultural options in the future and the continued harvest of some forest products.

The importance of restoring desirable pines, such as longleaf, to provide the RCW with sustainable quality habitat in the future, brings forth a possible exception to these regeneration method limitations. The interdisciplinary team concluded that the clearcutting method should be used to restore these pine species where it can be shown a definite long-term benefit would accrue and there is no short-term adverse effect on the RCW. Such exceptions would require site-specific environmental analysis.

Alternative D

The Forest Service proposes to revise the Regional Wildlife Habitat Management Handbook, FSH 2609.23R (Handbook), and the Southern Regional Guide to incorporate the revised Handbook. The revised Handbook would provide a new Regional direction for managing the red-cockaded woodpecker and its habitat. This direction would not be implemented until the National Forests with RCW populations have individually amended or revised their Forest Plans. This would occur within one to three years.

Elements of the Proposed Handbook Revision

Alternative D would:

(1) Establish criteria to delineate RCW Habitat Management Areas (HMA) and determine population objectives to ensure demographic stability.

Alternative D is based on delineation of HMAs. The size of the HMAs would be based on the number and distribution of existing clusters, active and inactive. Each HMA would be classified as one of five management intensity levels (MIL), which are based on the risk of extirpation (local extinction) faced by the RCW population in the HMA. The risk categories are determined by a population's size and trend.

(2) Eliminate sustained yield timber management.

Alternative D would not produce timber products on a sustained yield basis. A sustained flow of RCW habitat through time cannot be assured. Future regeneration of the forest would be dependent on natural seeding in openings created by dead and fallen trees.

(3) Establish Regional Handbook direction for management of the red-cockaded woodpecker and its habitat.

- Emphasize the use of artificial cavities and the moving of RCW from area to area (translocation) to speed population expansion and eventual recovery of the species.
- Emphasize thinning to reduce southern pine beetle risk and enhance RCW habitat.
- Emphasize prescribed fire, including growing season burns, to control midstory vegetation in the pine and pine-hardwood forest types throughout HMAs, especially within clusters, recruitment stands and replacement stands.
- Encourage adequate foraging habitat (6350 pine trees greater than 10" diameter, 30 years old or older within 1/2 mile of and connected to the clusters).
- Allow restoration of desirable pine species, such as longleaf pine, in areas where they occurred historically and would provide better RCW habitat.
- Monitoring intensity would be determined by Management Intensity Level, which reflects the size and vulnerability of the RCW population.

IMMEDIATE ACTIONS

The Forest Service would amend 11 Forest Plans immediately through the Record of Decision. The affected National Forests are: Alabama, Chattahoochee-Oconee, Cherokee, Daniel Boone, Croatan, Florida, Francis Marion, Kisatchie, Mississippi, Ouachita, and Texas. These amendments would identify and delineate tentative HMAs. Tentative HMA delineation would follow the process used to determine permanent HMAs in the revised Regional Handbook. These procedures are described in detail in Appendix A of the EIS.

The Forest Service would allow thinning, irregular shelterwood (two-aged), single-tree and group selection (uneven-aged) methods within tentative HMAs outside the 3/4-mile radius circles.

The regeneration methods proposed will preserve future management options until the time when the new RCW regional direction can be fully implemented. Forest Plan revisions or amendments may take one to three years to complete. Interim protects 3/4-mile radius circles around existing (active and inactive) clusters. Tentative HMAs extend protection to the suitable habitat areas between clusters. The allowed regeneration methods retain relatively high basal area and canopy cover, which would allow a wide range of silvicultural options in the future and the continued harvest of some forest products.

The importance of restoring desirable pines, such as longleaf, to provide the RCW with sustainable quality habitat in the future, brings forth a possible exception to these regeneration method limitations. The interdisciplinary team concluded that the clearcutting method should be used to restore these pine species where it can be shown a definite long-term benefit would accrue and there is no short-term adverse effect on the RCW. Such exceptions would require site-specific environmental analysis.

Table 3. Comparison of Alternatives by Specific Management Activities

Specific Activities	Alternative A (No Action)	Alternative B	Alternative C	Alternative D	Alternative E (Proposed Action)
Habitat Management Area (HMA) Designated	No, management areas are 3/4-mile radius circles around active and inactive clusters	No, only clusters, replacement and recruitment stands are managed specifically for RCW.	Yes, habitat management areas are contiguous blocks of habitat with a 10,000-ac. minimum size. See Table S-1.	Same as Alternative C	Same as Alternative C
Setting Population Objectives	Yes, will comply with population objectives in 1985 Handbook	Yes, similar to Alternative A, but modified to comply with FWS RCW Recovery Plan.	Yes, based on existing RCW distribution . A min. of 250 breeding pair in recovery populations and minimum of 25 breeding pairs in support populations	Same as Alternative C	Same as Alternative C
Management Intensity Levels (MIL) Designated	No, however, the 3/4-mile radius circles are broken down into two zones which receive different levels of management	No	Yes, 5 MIL are identified	Same as Alternative C	Yes, 4 MIL are identified
Cavity Restrictors/artificial cavities	Required , objective is 4 usable cavities per cluster	Same as Alternative A	Same as Alternative A in MIL 5-2, optional in MIL 1	Same as Alternative C	Same as Alternative A in MIL 4-2, optional in MIL 1
Translocation	Done as needed	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
Prescribed Burning	Yes, entire 3/4-mile circle on 2-5 year cycle, growing season burns encouraged.	Emphasized only in clusters, replacement and recruitment stands. Not required in foraging habitat.	Same as Alternative A, but done in entire HMA.	Same as Alternative C	Similar to Alternative C, but recognizes need to burn any season as needed
Pine Restoration	Encouraged with restrictions to prevent habitat fragmentation, longleaf pine only.	Similar to Alternative A, but restoration of other pine species allowed.	Similar to Alternative B, with restrictions to prevent habitat fragmentation.	Same as Alternative C	Similar to Alternative C, area control by forest management type allowed
Foraging Habitat	≥ 8,490 square feet pine basal area. ≥ 6350 pine stems. ≥ 10" DBH & > 30 years old.	Same as Alternative A	Same as Alternative A, plus provision to provide foraging for non-FS RCW	Same as Alternative C	Same as Alternative C, except minimum age of foraging trees reduced to 25 years, basal area requirement dropped
Future Nesting Habitat Mgmt. Outside Clusters, Replacement and Recruitment Stands.	Yes, utilizing thinning to enhance development and no regeneration cutting in the oldest 1/3 of pine acres until within 10-20 years of rotation age through the first rotation.	Not required outside clusters	Same as Alternative A	Same as Alternative A	Same as Alternative A

Table 3. Comparison of Alternatives by Specific Management Activities

Specific Activities	Alternative A (NoAction)	Alternative B	Alternative C	Alternative D	Alternative E (Proposed Action)
Rotation	120-year rotation on all pine species used by RCW is implied within 3/4 mile circles.	80 years longleaf and 70 years for other yellow pines with recruitment and replacement stands. Without R/R stands, 100 and 80 years.	Varies by site quality. Longleaf and shortleaf: 100-200 yrs. Loblolly and slash: 80-120 years. Virginia pine: 60-80 years . Within HMA	No rotation or planned regeneration	Virginia pine: 70 years. Loblolly & slash pine: 100 years Longleaf & shortleaf: 120 years Loblolly in high SPB risk areas: 80 years Within HMA
Thinning	Encouraged, if foraging is available. Leave tree priorities: 1. relict tree 2. potential cavity trees 3. trees ≥ 10" DBH 4. trees ≤ 10" DBH	Similar to Alternative A, standard silviculture guidelines used to select leave trees	Same as Alternative A	Yes, on limited basis	Same as Alternative A, with exceptions to allow thinning if foraging is limited in overly dense mature pine stands.
Regeneration					
Clearcut*	To be considered only for pine restorations, to regenerate wet slash pine sites, and damaged or sparse stands	Clearcutting of suitable habitat may occur if site-specific analysis determines adequate foraging is maintained and not isolated from cluster	Same as Alternative A, plus regeneration of Virginia and pitch pine	Only used to restore desirable pine species	Similar to Alternative C, but wet site slash pine regeneration is not allowed
Standard Shelterwood/Seed-tree	Not allowed	Allowed	Allowed only in MIL 1 and MIL 2	Not allowed, no planned regeneration	Allowed in MIL 1
Irregular Shelterwood	Allowed between 1/4 & 3/4 mile of clusters	Allowed	Allowed, mitigation varies by MIL	Not allowed, no planned regeneration	Similar to Alternative C, but different mitigation
Group Selection Methods	Not allowed	Allowed per Forest Plans	Allowed	Not allowed, no planned timber harvest	Allowed
Single Tree Selection	Not allowed	Allowed per Forest Plans	Allowed	Not allowed, no planned timber harvest	Allowed
Monitoring	Mandatory	Mandatory	Mandatory, intensity varies by MIL	Same as Alternative C	Mandatory, intensity varies by population size and trend (not MIL)

* The use of clearcutting has been limited in all alternatives to conform with the Chiefs 1330-1 letter dated June 4, 1992 and with the NFMA at 16 U.S.C. 1604 (g) (3) (F) (i). In keeping with this direction the amount of clearcutting will not vary significantly among the alternatives.

EVALUATION OF EFFECTS

There are 29 threatened or endangered species associated with RCW habitat or micro habitats within RCW habitat. Navasota ladies'-tresses is they only threatened or endangered species that should not be effected by RCW management. This species is only known to occur in post oak flats, and only one known location exists on national forest land. Because there should be no effect to it, Navasota ladies'-tresses will not be discussed any further. The other 28 species listed in Table 1 could potentially be effected by any of the five RCW management alternatives.

Several factors have been identified which may be causing RCW declines in the Southern National Forests. Krusac and Dabney (1994) identified three primary causes of RCW population declines including (1) lack of midstory control, (2) shortage of existing and potential cavity trees, and (3) habitat loss and the associated fragmentation and demographic isolation. The RCW management strategy also addressed three activities that more directly involve the RCW. These include the placement of restrictor plates, the installation of artificial cavities, and translocation of individual RCWs. These activities will benefit the species, but may affect individuals. These activities are identified as 4, 5, and 6 in the evaluation of effects.

(1) Lack of midstory control

Abandonment of clusters by RCW as a result of midstory encroachment is well documented (Hopkins and Lynn 1971, Van Balen and Doerr 1978, Locke et al. 1983, Hovis and Labisky 1985, and Conner and Rudolph 1989). Midstory vegetation may also reduce available foraging substrate for female RCW which prefer to forage on the trunks of pine trees. Therefore the greater the area which receives some degree of midstroy control, the greater the benefit to the RCW. Conner and Rudolph (1991b) found no adverse effects of midstory removal on RCW. Loeb (1993) found that removing midstory vegetation around individual cavity trees was not sufficient to keep southern flying squirrels from RCW cavity trees.

In all alternatives midstory control can be accomplished with heavy equipment, chainsaws, herbicide, or prescribed fire. Midstory control work will not occur during the nesting season in active clusters, except prescribed fire may be used during the nesting season in alternative C, D, and E (the proposed action). Herbicide treatment will be restricted to individual stem treatments, either injection, dormant season basal bark spray, or cut stem treatment. Individual stem treatments should preclude any potential adverse affects to listed plants.

Prescribed burning, especially growing season burning, should have beneficial effects on all species listed in Table 1 except the bald eagle. Bald eagles nest in dominant and super-dominant trees and forage primarily in aquatic ecosystems. Prescribed burning for RCW midstory control should have no affect on bald eagle.

Recovery plans and Federal Register notices have identified fire suppression as a cause of population declines in RCW, Mississippi sandhill crane, eastern indigo snake, gopher tortoise, and the plant species listed in Table 1. Midstory control including prescribed fire should be beneficial to these species. All the threatened or endangered animal species should benefit indirectly through improved habitat conditions resulting in increases in prey abundance and availability.

Midstory control with prescribed burning could possibly lead to adverse effects to individual American burying beetles. However, the overall effects should be beneficial because improved habitat conditions should produce larger and more abundant potential carrion items which the beetle could use to perpetuate the species.

ALTERNATIVE A

Alternative A would remove all hardwood midstory from approximately 125,000 acres of cluster sites. In addition, up to 1.33 million acres within 3/4 mile radius circles would receive some degree of midstory reduction. In areas where RCW clusters are widely dispersed and 3/4 mile circles do not overlap, midstory development outside of 3/4 mile zones may adversely affect RCW dispersal and potential nesting and foraging habitat. Midstory development outside 3/4 mile zones may also adversely affect Mississippi sandhill crane, gopher tortoise, eastern indigo snake, Gray, Indiana, and Virginia big-eared bats, and listed plant species by making this habitat less suitable for these species.

ALTERNATIVE B

Alternative B would remove all hardwood midstory within 50' of cavity trees and reduce the hardwood component within clusters to no more than 20 square feet of basal area. Approximately 125,000 acres would be treated. This alternative treats the fewest acres and therefore has the greatest potential for adverse affects on RCW and other species of concern. Quality RCW habitat would be produced on significantly fewer acres than any other alternative. Midstory development outside clusters may also adversely affect Mississippi sandhill crane, gopher tortoise, eastern indigo snake, and Gray, Indiana, and Virginia big-eared bats. Restricting midstory removal to only clusters may have the greatest impact on listed plants. Plants are not mobile and unless suitable habitat exists in their immediate vicinity, they are not likely to increase in abundance or distribution.

ALTERNATIVES C, D, AND E

Alternative C, D, and E treat approximately 177,000 acres in clusters. Within HMAs another 1.77 million acres receive some degree of midstory control treatment. This landscape level approach will provide the best opportunity for increases in abundance and distribution of RCW and other listed species.

(2) <u>Shortage of cavity trees</u>

Lack of suitable and potential cavity trees and cavity tree mortality are reasons for RCW population declines and lack of population expansion (Steirly 1957, Ligon 1970, Jackson 1971, Jackson et al.1979, Lennartz et al. 1983, Conner et al. 1991, Rudolph and Conner 1991). There is a definite preference for older trees and trees infected with redheart fungus (<u>Phellinus pini</u>) for cavity excavation (Jackson 1977, Conner and Locke 1982, Hooper et al. 1991a, Rudolph and Conner 1991). Redheart fungus is usually not abundant in southern pines until the trees are 80 to 100 years old (Wahlenberg 1946, 1960).

Probably the most limiting factor on future RCW population growth is the availability of potential cavity trees. Many populations do not have an adequate number of potential cavity trees due to past forest management practices prior to the RCW being listed as endangered. Most existing cavities are in relict trees, those trees left during the massive timber cuts of the early 1900's, prior to Forest Service ownership. These relicts are often 30 to 40, or more years older than the stands in which they occur.

The new stands growing up around these relicts are often too young to provide new cavity trees, and the remaining relicts are susceptible to windthrow and lightning. Relict trees are dying faster than younger trees can grow to replace them. Potential cavity tree recruitment will probably not exceed cavity/relict tree mortality until average stand age approaches 75-100 years, the average age of RCW start hole trees in loblolly and longleaf pines respectively. Past management provided future cavity trees by protecting small stands of older pine trees (recruitment stands) near active clusters. For a variety of reasons, the recruitment stand strategy has been unsuccessful. Frequently the oldest stands available were still too young to be potential cavity trees. Also, since most RCW populations were declining there was no population expansion and therefore no need for existing RCW to move to recruitment stands. Recruitment stands that have been enhanced with artificial cavities and midstory control have been readily occupied.

In the short-term the lack of suitable cavity trees can be mitigated with artificial cavities. In the long-term potential cavity trees can be provided through lengthening rotations, protecting existing relict trees, continuation of the recruitment stand strategy and protecting significant areas of existing older aged trees through the first rotation. These measures will ensure potential cavity trees in the shortest period of time.

All alternatives use artificial cavities and replacement and recruitment stand strategies to provide cavities. The differences in how alternatives provide potential cavity trees for the future come from rotation length, protection of existing relict trees, and protection of older age classes. Rotation length and harvest method will affect the number of potential cavity trees (Figures 1 and 2). Walker (1994) stated regardless of the effect of rotation age on numbers of potential cavity trees, there is little doubt that quality of such trees increases with age.

ALTERNATIVE A

Alternative A would use a 120 year rotation for all pine species. This will provide potential cavity trees in loblolly, slash, shortleaf, and longleaf pine types (Figures 1 and 2). A 120 year rotation in Virginia pine may have adverse effects on RCW. Virginia pine is short lived, shallow rooted, and blows down easily when stands become more open. Most Virginia pine would die of old age before 120 years. The resultant opening up of the stand could result in the remainder of the habitat blowing down rendering it unsuitable for RCW and not providing a sustained flow of habitat through time. The oldest 1/3 of suitable habitat is protected until near rotation and relict trees and potential cavity trees are also protected. The 120 year rotation combined with protection of relict trees, potential cavity trees, and protecting the oldest 1/3 of suitable habitat should not adversely effect RCW except in Virginia pine. Virginia pine is important in only two small populations. No other threatened or endangered species is likely to be significantly affected by this strategy.

ALTERNATIVE B

Alternative B has two rotation options. With replacement and recruitment stands, rotations would be 80 years for longleaf and 70 years for other yellow pine species. Clark (1992) found that on average it took longleaf pine 90 years to develop an adequate sized column of heartwood for cavity excavation, and it took loblolly pine 70 years. With an 80 year rotation in longleaf, the only trees which would ever become potential cavity trees would be located in clusters, recruitment and replacement stands. All other trees could be harvested before becoming suitable for cavity excavation.

The 70 year rotation in other yellow pine species could remove trees from areas outside of replacement and recruitment stands just as they became suitable for cavity excavation. This alternative has no requirement to protect relict trees, potential cavity trees, or older age classes. The 70/80 year rotation strategy would preclude RCW population expansion except into designated replacement and recruitment stands. This strategy has not been shown to be effective in the past and these rotations therefore would adversely affect RCW. These rotations should not have significant impacts on other threatened or endangered species. If there were no other constraints, these rotations could have adverse effects to the bald eagle. With the eagle's preference for dominant and super dominant trees for nest sites, these rotation lengths may not meet those conditions. However, the Forest Service has management requirements for lake fronts and riparian zones which should provide abundant potential bald eagle nest sites.

The other option is to extend rotations to 100 years for longleaf and 80 years for all other suitable yellow pine species. Recruitment stands would not be identified. These rotations would provide a 10 year window of opportunity for the RCW to colonize based on Clark's (1992) finds regarding heartwood development. Utilization rates may be low because of the RCW's preference for older trees with heart rot. In a regulated forest, truely old trees would be unavailable. Where this option was used, it has not been effective at increasing RCW populations. This alternative has no requirement to protect relict trees, potential cavity trees, or older age classes. This option could adversely affect RCW.

ALTERNATIVE C

Alternative C would implement rotations that vary by site quality and pine species. On poor sites (site index 60 and below), loblolly and slash pine would be managed on an 80 year rotation, while shortleaf and longleaf would be managed on a 100 year rotation. On average sites (site index 70-80), Virginia pine would be managed on a 60 year rotation, loblolly and slash pine would be managed on a 100 year rotation, and shortleaf and longleaf would be managed on a 150 year rotation. On good sites (site index 90 and above), Virginia pine would be managed on a 80 year rotation, loblolly and slash pine would be managed on a 120 year rotation, and shortleaf and longleaf would be managed on a 200 year rotation. The general perception is that there would be vast acreages of shortleaf and longleaf on 200 year rotations. This would not be the case. There are very few areas where these pine species are growing on a site index of 90 and above. The number of potential cavity trees for various rotations are shown in Figures 1 and 2. This alternative does protect the oldest 1/3 of suitable habitat until near rotation and also protects relict trees and potential cavity trees.

The proposed rotations in this alternative combined with protection of relict trees, potential cavity trees, and protecting the oldest 1/3 of suitable habitat until near rotation should benefit RCW and not significantly affect the other threatened or endangered species.

ALTERNATIVE D

Alternative D has no planned regeneration, therefore no rotation length is established. Without planned regeneration, there should be an abundance of potential cavity trees over the next 50 to 100 years. Because there is no planned regeneration of forest stands, a sustained flow of potential cavity trees cannot be ensured in the long-term (hundreds of years). Regeneration would be dependent on natural disturbance forces. The resultant habitat conditions may be one of a boom and bust situation regarding cavity tree availability.

Numerous individuals have stated that historically RCW habitat perpetuated itself without management by humans. On a very large scale this was true. There are reports that historically longleaf pine occupied up to 90 million acres of the coastal plain, with millions of additional acres available in loblolly, slash, and shortleaf pines. Catastrophic events regenerated parts of the forest but there were millions of acres of suitable habitat for RCW to move to. This is not the case today. We are trying to recover the RCW on only a small remnant of the original habitat. We cannot rely on natural disturbance forces to perpetuate RCW habitat. We must manage RCW habitat to provide a sustained flow of potential cavity trees through time.

Because of the inability to ensure a sustained flow of potential cavity trees, and the potential for a boom and bust situation regarding cavity trees, alternative D may have adverse effects on RCW. With the thinnings and prescribed burning that would occur under alternative D, other threatened or endangered species should not be significantly affected.

ALTERNATIVE E

Alternative E would implement rotations that vary by pine species. Loblolly and slash pine would be managed on an 100 year rotation, while shortleaf and longleaf would be managed on a 120 year rotation. Virginia pine would be managed on a 70 year rotation. In areas with histories of southern pine beetle epidemics, an 80 year rotation option exists for loblolly and shortleaf pines. If this option is used, an additional requirement goes into effect to provide for potential cavity trees. If the 80 year option is used, 25 to 30 square feet of basal area per acre, but not less than 10 trees per acre, must be left in regeneration areas in perpetuity. The reserve trees will be dispersed over the regeneration area, rather than clumped. All options of this alternative protect the oldest 1/3 of suitable habitat until near rotation and also protects relict trees and potential cavity trees.

Clark (1992) found that on average it took longleaf pine 90 years to develop an adequate sized column of heartwood for cavity excavation and it took loblolly 70 years. In areas not managed using the southern pine beetle option, all trees would be available as potential cavity trees for at least 30 years. Potential cavity trees should be abundant in this alternative (Figures 1 and 2). The proposed rotations in this alternative combined with protection of relict trees, potential cavity trees, and protecting the oldest 1/3 of suitable habitat until near rotation will have beneficial effects to RCW and not significantly affect other threatened or endangered species.

(3) <u>Habitat Loss, Fragmentation, and Demographic Isolation</u>

Although RCWs will use many pine forest types, they are most closely associated with the longleaf pine forest. Historically, longleaf pine dominated between 60 and 90 million acres of the coastal plain region (Croker 1987, Frost 1993). Today less than 4 million acres of the original longleaf type remain as second growth stands (Landers et al. 1989). Habitat loss, fragmentation, and the associated demographic isolation are primary causes of RCW population declines (Lennartz et al. 1983, Conner and Rudolph 1991a).

Margules et al. (1988) and Sanders et al. (1991) when discussing managing for biodiversity in an already fragmented system state, the first step in management must be the determination of the minimum subset of existing remnants required to represent the diversity of a given area. The habitat management area (HMA) delineation process is this first step. Habitat management area designation involves the delineation of an area that represents the desire future demographic configuration of an RCW population. It is a strategy for management at a landscape scale. The intent is to manage an area large enough to avoid or overcome the adverse effects of fragmentation and to reduce the risks involved with small populations and stochastic events. Fragmentation will be controlled primarily by designating HMAs and with restrictions on regeneration, protecting relict trees, and protecting the older age classes. The following analysis will deal only with HMA designation because restrictions on regeneration and protection of older age classes was discussed under shortage of cavity trees.

Alternative A: Habitat management areas would be 3/4-mile radius circles around active and inactive clusters. In large, dense populations with overlapping circles, adverse effects should be minimal. Existing RCW population densities will ensure continuity of suitable habitat. RCW populations where 3/4-mile circles do not overlap may be adversely affected as the area between 3/4 mile circles are regenerated. Habitat may become fragmented, clusters could become isolated from one another, and the populations may decline. Approximately 1.4 million acres of pine and pine-hardwood forest would be included within the 3/4-mile radius circles.

The cumulative effects of managing RCW habitat in 3/4-mile radius circles around clusters has the potential for continual fragmentation of habitat between 3/4-mile circles. There is also a high probability of short rotation and habitat modification on adjacent private and corporate lands (USDA 1988). The combination of short rotation and habitat modification on private lands and the likelihood of habitat fragmentation outside 3/4-mile zones would likely lead to demographic isolation of some RCW groups. As the groups become more isolated, there may be a collapse of the population because dispersing birds fail to find mates and suitable nesting habitat. The potential effects would be most severe in smaller populations (Conner and Rudolph 1991a).

It is unlikely that somewhat shorter rotations occurring outside of 3/4 mile zones would have significant effects on other threatened or endangered species.

Alternative B: In Alternative B, HMAs are not identified. Management of RCWs is based on active clusters and adequate acres of foraging habitat adjacent to each cluster to provide the necessary number of foraging stems. Opportunities for habitat fragmentation and cluster isolation are greatest in this alternative. There is a high probability of adverse effects on population stability and expansion, caused by demographic isolation. The greatest potential for adverse effects is in the small populations. Approximately 125,000 acres of pine and pine-hardwood forest would be included in clusters. Since foraging is based on number of stems, it is not possible to realistically estimate the total acres which will be allocated to RCW management.

The cumulative effects would be similar to Alternative A, except there is a much greater probability of habitat fragmentation and demographic isolation due to the much smaller area around each cluster being managed specifically for RCW. This could lead to population declines again, with the most serious effects in the smaller population.

It is unlikely the lack of HMA designation would have significant effects on other threatened or endangered species.

Alternatives C-E: Establishing HMAs in these alternatives would allow an ecosystem approach to RCW recovery. HMA size is dependent on population objectives and habitat quality. HMAs would contain a minimum of 10,000 acres of contiguous suitable habitat. In some cases, HMAs include entire national forests. The continuity of RCW habitat over large areas should preclude isolation of clusters and allow for good dispersal of RCWs across the habitat. An estimated 2 million acres of pine and pine-hardwood forest will be included within RCW HMAs.

Cumulative effects of establishing HMAs should all be positive. The ecosystem approach would provide for nesting and foraging habitat and should allow RCW social interaction at the landscape level which should help in successful dispersal of subadults. The inclusion of private lands within HMA boundaries may lead to some habitat fragmentation, but it should not lead to demographic isolation.

Managing RCW habitat at a landscape scale will not significantly affect other threatened or endangered species.

(4) Placement of Restrictor Plates

Restrictor plates will be used in all alternatives. Restrictors are specially designed stainless steel plates that have an entrance slot large enough for RCW to get in, but small enough to keep out larger cavity competitors. Restrictors are used to keep larger woodpeckers from enlarging the cavity entrance. Restrictors are placed so that the cavity entrance is not impeded, and nailed in place. Use of restrictors will have a beneficial effect on overall RCW recovery. However, there is a remote possibility that individuals may be adversely affected if the restrictor is not properly placed, or becomes dislodged over time. Restrictors will not affect any other listed species.

(5) Installation of Artificial Cavities

Artificial cavities will be used in all alternatives. Artificial cavities are used to aid population expansion and to stabilize existing clusters when cavities trees are lost. Three types of artificial cavities will be used including start holes, drilled cavities, and insert boxes. Use of artificial cavities will have beneficial effects on overall RCW recovery. There is a remote possibility that individuals may be adversely affected if an artificial cavity is not resin proof. Cavity failure could be caused by resin leaking through a crack in an insert box, or an incomplete seal of the access hole for drilled cavities. Artificial cavities will no affect other listed species.

(6) Translocation

Translocation will be used in all alternatives. Translocations are used to create potential breeding pairs where single birds currently exist and to aid in population expansion. Translocations will occur within and between populations. Translocation will have beneficial effects on overall recovery. Because translocation involves directly handling and transporting individuals, there is the potential for direct mortality to occur. Translocation involves banding of individuals including adults, juveniles, and nestlings, as well as capturing individuals and moving them to the desired location. These locations could be several hundred miles from the capture site. There is the possibility that individuals may be adversely affected, including the remote possibility of death. Translocation of RCWs will have no effect on other listed species.

DETERMINATION OF EFFECTS

ALTERNATIVE A - MAY AFFECT RCW AND OTHER LISTED SPECIES

The combination of 3/4 mile radius habitat management areas and the potential for dense hardwood midstory to develop outside of 3/4 mile zones, may lead to habitat fragmentation and demographic isolation. This alternative may affect (adverse effect) red-cockaded woodpeckers at the species level. Placement of restrictors, installation of artificial cavities and translocation also may affect individual RCWs. The habitat fragmentation and development of dense hardwood midstory may affect Mississippi sandhill crane, gopher tortoise, and eastern indigo snake. The less frequent and less intense fires that would likely occur outside of 3/4 mile zones which leads to the development of hardwood midstory, may affect plants listed in Table 1. Hardwood midstory development may preclude population expansion of these plants. Midstory development may affect foraging habitat quality for and foraging efficiency of, gray, Indiana, and Virginia big-eared bats (Adam et al. 1994).

ALTERNATIVE B - MAY AFFECT RCW AND OTHER LISTED SPECIES

The combination of no landscape scale management strategy, the potential for dense hardwood midstory to develop outside of clusters, and either of the rotation options may lead to habitat fragmentation, demographic isolation, and a shortage of potential cavity trees. This alternative may affect (adverse effect) red-cockaded woodpeckers at the species level. Placement of restrictors, installation of artificial cavities, and translocation also may affect individual RCWs. The habitat fragmentation and development of dense hardwood midstory may affect Mississippi sandhill crane, gopher tortoise, and eastern indigo snake. The less frequent and less intense fires that would likely occur outside of designated RCW habitat may lead to the development of hardwood midstory, which may affect plants listed in Table 1. Hardwood midstory development may preclude population expansion of these plants. Midstory development may affect foraging habitat quality for and foraging efficiency of, gray, Indiana, and Virginia big-eared bats (Adam et al. 1994).

ALTERNATIVE C - MAY AFFECT RCW; NOT LIKELY TO ADVERSELY AFFECT OTHER SPECIES

Placement of restrictors, installation of artificial cavities, and translocation may affect individual RCWs. The combination of a habitat management areas, treatment of midstory vegetation across the landscape, longer timber rotation, and protection of relict trees, potential cavities trees, and the oldest 1/3 of suitable habitat would have beneficial effects on the red-cockaded woodpecker at the species level. Habitat fragmentation and demographic isolation should not be a problem. Potential cavity trees should be abundant, with cavity trees available on nearly every acre. The entire area within an HMA should be available for RCW population expansion. The conditions created across the landscape should be favorable for population expansion of all species listed in Table 1, with the possible exception of peregrine falcon and gray, Indiana, and Virginia big-eared bats. Foraging conditions should be improved for these species.

ALTERNATIVE D - MAY AFFECT RCW; NOT LIKELY TO ADVERSELY AFFECT OTHER SPECIES

The combination of a habitat management areas, treatment of midstory vegetation across the landscape, and no timber harvest should create conditions favorable for population expansion of all species listed in Table 1, with the possible exception of peregrine falcon and gray, Indiana, and Virginia big-eared bats. Foraging conditions should be improved for these species. Potential cavity trees should be abundant for the next 50 to 100 years. Because there is no planned regeneration of forest stands, a sustained flow of potential cavity trees cannot be ensured in the long-term (hundreds of years). Regeneration would be dependent on natural disturbance forces. The resultant habitat conditions may be one of a boom and bust situation regarding cavity tree availability. Because of this, this alternative may effect (adverse effect) red-cockaded woodpecker at the species level. Placement of restrictors, installation of artificial cavities, and translocation also may affect individual RCWs.

ALTERNATIVE E (The proposed action) - MAY AFFECT RCW; NOT LIKELY TO ADVERSELY AFFECT OTHER SPECIES

Placement of restrictors, installation of artificial cavities, and translocation may affect individual RCWs. The combination of a habitat management areas, treatment of midstory vegetation across the landscape, moderate timber rotations, and protection of relict trees, potential cavities trees, and the oldest 1/3 of suitable habitat would have beneficial effects on the red-cockaded woodpecker at the species level. Habitat fragmentation and demographic isolation should not be a problem. Potential cavity trees should be abundant, with cavity trees available on all acres. The entire area within an HMA should be available for RCW population expansion. The conditions created across the landscape should be favorable for population expansion of all species listed in Table 1, with the possible exception of peregrine falcon and gray, Indiana, and Virginia big-eared bats. Foraging conditions should be improved for these species.

SUMMARY OF ESA SECTION 7 OF DETERMINATION OF EFFECTS

Alternatives A, B, C, D and E may affect red-cockaded woodpeckers.

Alternatives A and B may affect Mississippi sandhill crane, gopher tortoise, eastern indigo snake, the plants listed in Table 1, and gray, Indiana, and Virginia big-eared bats.

Alternative C, D, and E are not likely to adversely affect other species listed in Table 1.

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Figure 1

Effects of Rotation and Regeneration Method on Production of Potential Nesting Habitat on 1000 Acres of Loblolly Pine on an Average Site.

Number per 1,000 acres of potential loblolly pine cavity trees (≥ 18 inches DBH and ≥ 70 years old) by age classes for different regeneration methods and different rotation ages. CC = Clearcut; SW = Shelterwood; SW-20% Cl = Shelterwood with 20% in Clumps; 40SR - Irregular Shelterwood - 40 Basal Area - Staged Removal - 20% in Clumps; 40NR - Irregular Shelterwood - 40 Basal Area - No Removal - No Clumps; 30NR = Irregular Shelterwood - 30 Basal Area - No Removal - No Clumps; G Sel = Group Selection; S-T Sel = Single-Tree Selection. See text for explanation of regeneration methods.

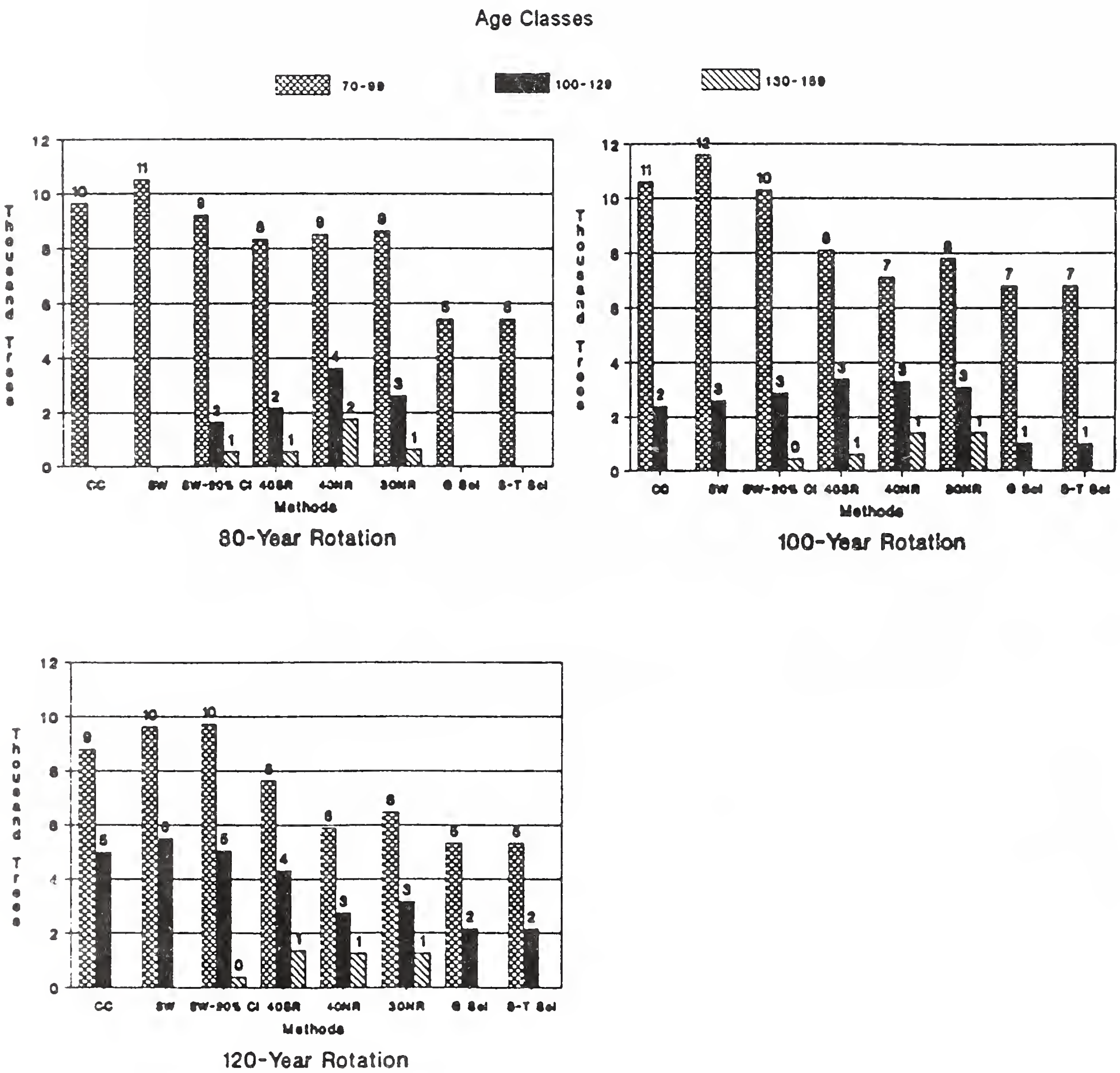
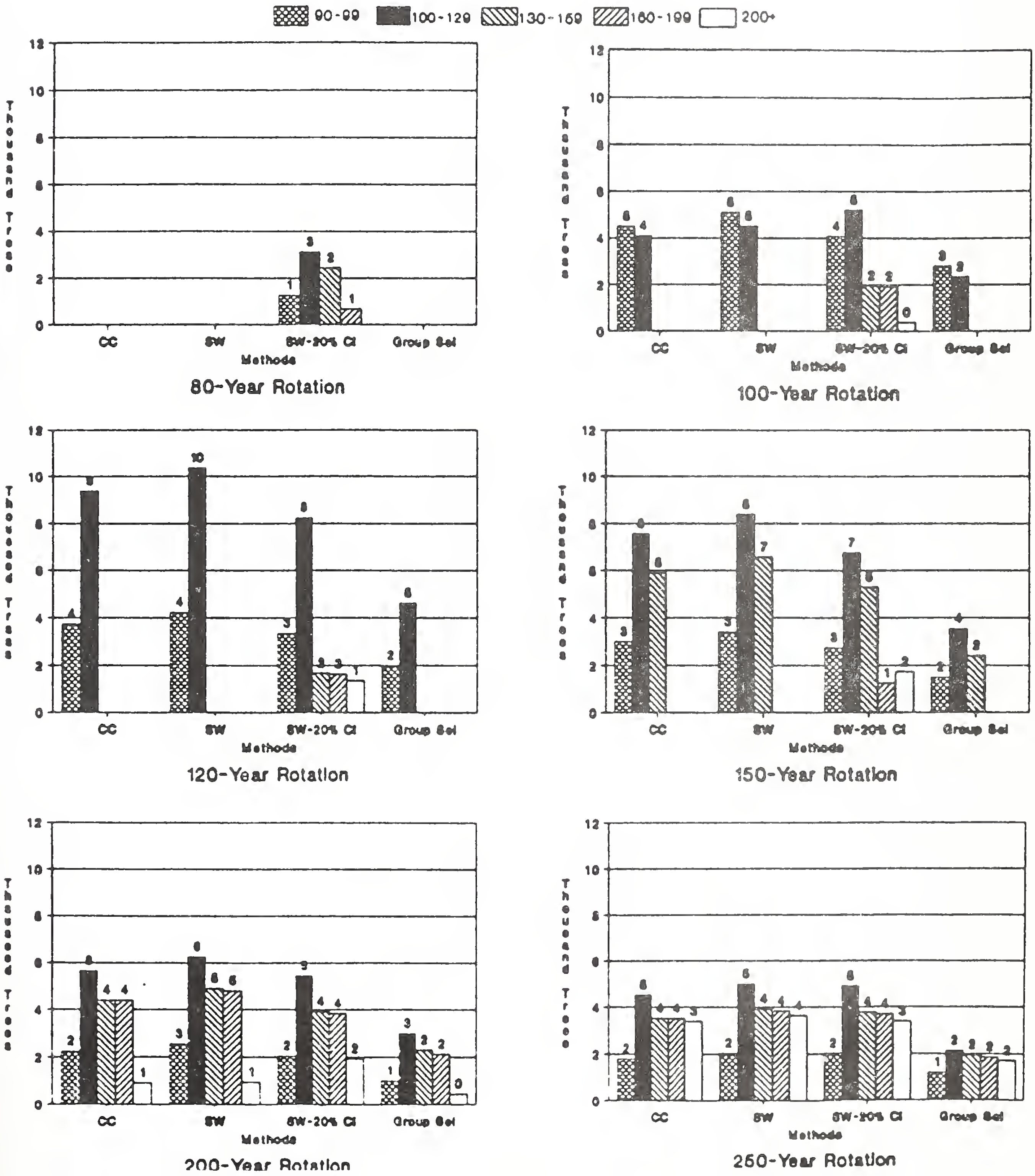


Figure 2

Effects of Rotation and Regeneration Method on Production of Potential Nesting Habitat on 1000 Acres of Longleaf Pine on an Average Site.

Number per 1,000 acres of potential longleaf pine cavity trees (≥ 15 inches DBH and ≥ 90 years old) by age classes fc different regeneration methods and different rotation ages. CC = Clearcut; SW = Shelterwood; SW-20% CL = Shelterwooc with 20% In Clumps; Group Sel = Group Selection. See text for explanation of regeneration methods.

Age Classes



SUPPLEMENT TO THE BIOLOGICAL ASSESSMENT USDA FOREST SERVICE, SOUTHERN REGION MANAGEMENT OF THE RED-COCKADED WOODPECKER AND ITS HABITAT ON NATIONAL FORESTS IN THE SOUTHERN REGION

REASONS FOR SUPPLEMENT

During the consultation process with USFWS, it was determined that two listed plant species were not addessed in the original Biological Assessment. These species are Michaux's sumac (Rhus michauxii) and gentian pinkroot (Spigelia gentianoides). It was also determined that although there was considerable discussion in the EIS and the consultation process regarding past and future forest management activities, there was little discussion of ongoing timber sales or those sales likely to be advertised by September 30, 1995. The following analysis addresses the above listed short-comings of the original Biological Assessment, which was transmitted to FWS on September 2, 1994.

BIOLOGICAL BACKGROUND

With the addition of Michaux's sumac and gentian pinkroot, there are 31 threatened or endangered species associated with RCW habitats. These species include those that occur or are likely to occur in RCW habitats or micro-habitats within RCW habitat, and those species that do not occur on National Forests but which have suitable habitat available, such as the red-wolf (Canus rufus).

Michaux's sumac occurs in Davie, Franklin, Hoke, Moore, Richmond, Robeson, Scotland, and Wake Counties, North Carolina, and Elbert County, Georgia. Historically, Michaux's sumac occured in South Carolina and Florida as well. Michaux's sumac usually occurs on sand or sandy loam soils in the coastal plain and piedmont physiographic provinces. This species is not known to currently exist on National Forest lands, but suitable habitat for the species probably does exist. Primary causes of population declines include habitat loss due to agricultural and residential development, and fire suppression. Fire or some other type of disturbance appears essential for maintaining the open habitat conditions preferred by this species.

Gentian pinkroot is a perennial herb. This plant is known from Calhoun, Gadsden, Jackson, Liberty, and Washington Counties, Florida. Gentian pinkroot occurs in mixed pine-hardwood forests, but the largest known population is in a longleaf pine wiregrass community. Little is known about the causes of population declines of this species, but its association with longleaf pine wiregrass communities would indicate that fire suppression may have played a role in the population declines.

TIMBER SALES

Timber sales within 3/4 mile radius circles around RCW clusters will be consistent with the direction that has been in effect and will remain in effect when the Record of Decision is signed, and therefore are not considered in the following analysis. The timber sale analysis will consider sales outside of 3/4 mile radius circles around RCW clusters but within tentative HMAs that are currently sold and under contract, those that are likely to be advertised by July 1, 1995, and those sales likely to be advertised between July 1 and September 30, 1995. These sales are in compliance with existing interim RCW management direction, all have had Biological Evaluations prepared for them, all have undergone the necessary consultation with USFWS, and all have complete NEPA documentation. Because of the significant expenditure of time and money on these sales, the Regional Forester plans to continue implementing these sales after the Record of Decision is signed without interruption, based on the review for effects and consistency documented in the individual Biological Evaluations. Proceeding with these sales will be part of the implemention direction in the Record of Decision. The new regional RCW strategy will go into effect 30 days after the signing of the Record of Decision, and will change some management direction. Changes in management guidelines will make some of the sales or sale units inconsistent with the new direction, in relation to the types of harvest methods allowed within tentative HMAs.

Because of these inconsistencies with the new direction, it was essential to re-evaluate each of these sales on an HMA basis. The cumulative effects of all sales sold and under contract, sales likely to be advertised by July 1, 1995, and those sales likely to be advertised between July 1 and September 30, 1995, were analyzed on an HMA basis by District or Forest biologists. The results of these analyses were documented in Biological Evaluations for each HMA. These Biological Evaluations and sales information are part of the record for the RCW EIS and can be viewed at the USDA Forest Service office in Atlanta, GA. Based on these Biological Evaluations and sales information, I analyzed the effects of these sales regionally, on both the RCW and our ability to implement our new RCW management strategy. This supplement documents that analysis. The Timber Sales Appendix to this supplement identifies sales by HMA and also lists the determination of effect arrived at by the District or Forest biologist.

Table 1 of this supplement presents regional totals for sales sold and under contract, sales likely to be advertised by July 1, 1995, and sales likely to be advertised between July 1 and September 30, 1995.

Table 1. Regional Sales Information in Acres (un-cut units only)

	SOLD	ADVERTISED BY 7/1/95	ADVERTISED 7/1/95- 9/30/95	TOTAL
THINNINGS	28,595	11,324	6,122	46,041
CLEARCUT	4,218	1,941	817	6,976a
SHELTERWOOD	716	797	366	1,879
SEEDTREE	1,441	346		1,787
SEEDTREE REMOVAL	484	370		854
UNEVEN-AGED	107			107

a: 2,322 acres (33%) of clearcutting is directly related to longleaf pine restoration.

There are 46,041 acres of pine thinning identified in sales within tentative HMAs, but outside 3/4 mile radius circles. These thinnings will improve RCW habitat by maintaining the open stand conditions the RCW prefer. There are 11,496 acres of pine regeneration identified in sales within tentative HMAs, but outside 3/4 mile radius circles. This is 0.6% of the total suitable RCW habitat within tentative HMAs. This amount of regeneration should not affect the RCW, as all sales are at least 3/4 mile from existing RCW clusters.

Based on the large amount of thinning to improve RCW habitat and the small amount of regeneration, continuing with the harvesting listed in Table 1 should not affect the RCW or our ability to implement any one of the five alternative listed in the RCW EIS. Any sale that is not listed in the Timber Sale Appendix must be consistent with the direction existing at the time the sale is advertised.

DETERMINATION OF EFFECTS

Considering the additional information in this supplement and the original Biological Assessment, the determinations of effect of the five alternatives are as follows. These determinations of effect supersede those identified in the original Biological Assessment of September 2, 1994.

ALTERNATIVE A - MAY AFFECT RCW AND OTHER LISTED SPECIES

The combination of 3/4 mile radius habitat management areas and the potential for dense hardwood midstory to develop outside of 3/4 mile zones, may lead to habitat fragmentation and demographic isolation. This alternative may effect (adverse effect) red-cockaded woodpeckers. The habitat fragmentation and development of dense hardwood midstory may also adversely effect Mississippi sandhill crane, gopher tortoise, and eastern indigo snake. The less frequent and less intense fires that would likely occur outside of 3/4 mile zones which

leads to the development of hardwood midstory, may have adverse affects on Michaux's sumac and gentian pinkroot as well as the plants listed in Table 1 of the original Biological Assessment. Hardwood midstory development may preclude population expansion of these plants. Midstory development may also adversely effect foraging habitat quality for and foraging efficiency of, gray, Indiana, and Virginia big-eared bats (Adam et al. 1994).

ALTERNATIVE B - MAY AFFECT RCW AND OTHER LISTED SPECIES

The combination of no landscape scale management strategy, the potential for dense hardwood midstory to develop outside of clusters, and either of the rotation options may lead to habitat fragmentation, demographic isolation, and a shortage of potential cavity trees. This alternative may effect (adverse effect) red-cockaded woodpeckers. The habitat fragmentation and development of dense hardwood midstory may also adversely effect Mississippi sandhill crane, gopher tortoise, and eastern indigo snake. The less frequent and less intense fires that would likely occur outside of designated RCW habitat may lead to the development of hardwood midstory, which may have adverse affects on Michaux's sumac and gentian pinkroot as well as the plants listed in Table 1 of the original Biological Assessment. Hardwood midstory development may preclude population expansion of these plants. Midstory development may also adversely effect foraging habitat quality for and foraging efficiency of, gray, Indiana, and Virginia big-eared bats (Adam et al. 1994).

ALTERNATIVE C - MAY AFFECT RCW; NOT LIKELY TO ADVERSELY AFFECT OTHER LISTED SPECIES

Placement of restrictors, installation of artificial cavities, and translocation may affect individual RCWs. The combination of a habitat management areas, treatment of midstory vegetation across the landscape, longer timber rotation, and protection of relict trees, potential cavities trees, and the oldest 1/3 of suitable habitat would have beneficial effects on the red-cockaded woodpecker at the species level. Habitat fragmentation and demographic isolation should not be a problem. Potential cavity trees should be abundant, with cavity trees available on nearly every acre. The entire area within an HMA should be available for RCW population expansion. The conditions created across the landscape should be favorable for population expansion of Michaux's sumac and gentian pinkroot as well as all species listed in Table 1 of the original Biological Assessment, with the possible exception of peregrine falcon and gray, Indiana, and Virginia big-eared bats. Foraging conditions should be improved for these species.

ALTERNATIVE D - MAY AFFECT RCW; NOT LIKELY TO ADVERSELY AFFECT OTHER LISTED SPECIES

The combination of a habitat management areas, treatment of midstory vegetation across the landscape, and no timber harvest should create conditions favorable

for population expansion of Michaux's sumac and gentian pinkroot as well as all species listed in Table 1 of the original Biological Assessment, with the possible exception of peregrine falcon and gray, Indiana, and Virginia big-eared bats. Foraging conditions should be improved for these species. Potential cavity trees should be abundant for the next 50 to 100 years. Because there is no planned regeneration of forest stands, a sustained flow of potential cavity trees cannot be ensured in the long-term (hundreds of years). Regeneration would be dependent on natural disturbance forces. Prior to European settlement, natural forces did regenerate the forests. However, there were 100s of millions of acres of unfragmented potential RCW habitat. We are going to recover the RCW on only a small remnant of the original habitat. On these small remnants, natural forces will not guarantee a sustained flow of RCW habitat through time, and could limit our ability to recover the RCW. The resultant habitat conditions may be one of a boom and bust situation regarding cavity tree availability. Because of this, this alternative may effect (adverse effect) red-cockaded woodpecker at the species level. Placement of restrictors, installation of artificial cavities, and translocation also may affect individual RCWs.

ALTERNATIVE E (The proposed action) - MAY AFFECT RCW; NOT LIKELY TO ADVERSELY AFFECT OTHER LISTED SPECIES

Placement of restrictors, installation of artificial cavities, and translocation may affect individual RCWs. The combination of a habitat management areas, treatment of midstory vegetation across the landscape, moderate timber rotations, and protection of relict trees, potential cavities trees, and the oldest 1/3 of suitable habitat would have beneficial effects on the red-cockaded woodpecker at the species level. Habitat fragmentation and demographic isolation should not be a problem. Potential cavity trees should be abundant, with cavity trees available on all acres. The entire area within an HMA should be available for RCW population expansion. The conditions created across the landscape should be favorable for population expansion of Michaux's sumac and gentian pinkroot as well as all species listed in table 1 of the original Biological Assessment, with the possible exception of peregrine falcon and gray, Indiana, and Virginia big-eared bats. Foraging conditions should be improved for these species.

SUMMARY OF ESA SECTION 7 DETERMINATION OF EFFECTS

Alternatives A, B, C, D, and E may affect red-cockaded woodpeckers.

Alternatives A and B may effect Mississippi sandhill crane, gopher tortoise, eastern indigo snake, Michaux's sumac, gentian pinkroot, the plants listed in table 1 of the original Biological Assessment, and gray, Indiana, and Virginia big-eared bats.

Alternative C, D, and E are not likely to adversely affect Michaux's sumac, gentian pinkroot, or all other species listed in Table 1 of the September 2, 1994, Biological Assessment.

Dennis L. Krusac

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Endangered Species Specialist
Southern Region

April 5, 1995

TIMBER SALE APPENDIX

NATIONAL FORESTS IN ALABAMA

BANKHEAD HMA

Mile Creek Sale, Compartment 127 (C 127): sold
C 125 Sale: to be advertised by 7/1/95
C 161, 164, 165, 166 Sale: to be advertised by 7/1/95

Determination of Affect: not likely to adversely effect

CONECUH HMA

Eden Creek Sale, C 10, 19: sold
Alaflora Sale, C 65, 67, 68: sold
Sand Point Sale, C 34, 46: sold
Bay Branch Sale, C 42: to be advertised by 7/1/95
Wiggins Sale, C 38, 41, 42: to be advertised by 7/1/95
Blue Tortoise Sale, C 22, 28, 58: to be advertised by 7/1/95
Thinner Sale, C 12, 19, 36, 44: to be advertised between 7/1 & 9/30/95

Determination of Affect: not likely to adversely effect

OAKMULGEE HMA

C 9, 12 Sale: sold
C 56, 57, 64 Sale: sold
C 52, 55 Sale: sold
C 49, 50, 51 Sale: sold
C 131 Sale: sold
C 132, 143 Sale: sold
C 145 Sale: sold
C 31, 32, 33, 44 Sale: sold
C 128, 129, 130, 134 Sale: sold
C 144 Sale: to be advertised by 7/1/95
C 135 Sale: to be advertised by 7/1/95
C 20 Sale: to be advertised between 7/1 & 9/30/95

Determination of Affect: not likely to adversely effect

TALLADEGA/SHOAL CREEK HMA

Quail Improvement Sale, C 32, 33, 39: sold
Bankhead Tower Sale, C 62, 64: sold
Tip-Top Sale, C 65, 66, 68: sold
Highrock Lake Sale, C 50, 51, 52: sold
Red-cockaded Woodpecker #3 Sale, C 24, 32, 33: sold
Seehatchee Sale, C 274, 278, 282, 283: sold
Seedtree Sale, C 202, 204, 234, 237, 238, 283: sold
Barbaree Sale, C 220, 221, 230, 231: sold
Hopeful Sale, C 209, 210: sold
Pine Mountain Sale, C 201, 206: sold

TIMBER SALE APPENDIX

TALLADEGA/SHOAL CREEK HMA cont.

Lower Highrock Sale, C 57, 59: to be advertised by 7/1/95
Peartree Sale, C 18, 26, 33: to be advertised by 7/1/95
County Line Sale, C 208, 211: to be advertised by 7/1/95
Ebenezer Sale, C 212, 215, 216: to be advertised between 7/1 & 9/30/95

Determination of Affect: not likely to adversely effect

DANIEL BOONE NATIONAL FOREST

DANIEL BOONE HMA

Big Branch Sale, C 4009, 4100, 4101: sold
Cane Branch Sale, C 4074, 4075: sold
Curd Garden Sale, C 4218, 4219: sold
Whitman Branch Sale, C 4201, 4203, 4211: sold
Little Lick Sale, C 5031, 5032, 5041: sold
Neelys Creek Sale, C 5035, 5036: sold
Fishing Creek Sale, C 4210, 4214: to be advertised by 7/1/95
Little Dog Slaughter Sale, C 4222: to be advertised by 7/1/95
Slick Shoals Sale, C 4227, 4229: to be advertised by 7/1/95
Devils Creek Sale, C 4217, 4220: to be advertised by 7/1/95
Hinesfield Ridge Sale, C 5020: to be advertised between 7/1 & 9/30/95
Taylor Ridge Sale,C 6062, 6064: to be advertised between 7/1 & 9/30/95

Determination of Affect: not likely to adversely effect

OCONEE NATIONAL FOREST

OCONEE HMA

C 106 Sale: sold
C 118 Sale: sold
C 121, 122, 123, 124, 134 Sale: sold

Determination of Affect: not likely to adversely effect

CHEROKEE NATIONAL FOREST

CHEROKEE HMA

No sales are sold or planned within the tentative HMA.

Determination of Affect: No effect

TIMBER SALE APPENDIX

NATIONAL FORESTS IN FLORIDA

APALACHICOLA HMA

Lindsey Bay Sale, C 43, 47: sold
Carr Sale, C 47: sold
Gopher Sale, C 3: sold
Queens Sale, C 48: sold
Double Branch Sale, C 88: sold
Hitchcock Sale, C 90: sold
Haw Sale, C 91: sold
Ford Sale, C 235: sold

Determination of Affect: not likely to adversely effect

WAKULLA HMA

Grimes Bay Sale, C 338, 337, 334, 350: sold
Horn Sale, C 214: sold
Tyler Salvage Sale, C 342: sold
Woodlake Sale, C 355, 356, 357: sold
On Site Sale, C 203, 206, 207, 208, 244, 308, 322, 331, 333, 342, 343: to be advertised by 7/1/95
Live Oak Sale, C 333: to be advertised by 7/1/95
Arbor Branch Sale, C 326, 328: to be advertised by 7/1/95

Determination of Affect: not likely to adversely effect

OSCEOLA HMA

Hurricane Bay Sale, C 73: sold
Surveyors Bay Sale, C 2: sold
Wildcat Sale, C 71: sold
Swarthout Sale, C 95: sold
Ocean Bay Sale, C 12: sold
Multi Sale, C 23, 45, 101: sold
Research Sale, C 102: sold
Bear Bay Sale, C 37: sold
Findley Thin Sale, C 100: to be advertised by 7/1/95
Greenfield Sale, C 61: to be advertised by 7/1/95

Determination of Affect: not likely to adversely effect

OCALA HMA

No sales are sold or planned to be advertised in the HMA outside of 3/4 mile radius circles.

Determination of Affect: No effect

TIMBER SALE APPENDIX

KISATCHIE NATIONAL FOREST

CATAHOULA HMA

PBS 5 & 8 Sale, C 5, 8: sold
Hunt 63, 65, & 66 Sale, C 63, 65, 66: sold
Willamette 61 & 62 Sale, C 61, 62: sold
C 9, 10 Sale: to be advertised by 7/1/95

Determination of Affect: not likely to adversely effect

EVANGELINE HMA

Willamette 367 Sale, C 367: sold
Leesville 15 Sale, C 15: sold
LP 53 Sale, C 53: sold
Leesville 45 Sale, C 45: sold
C 57 Sale: to be advertised between 7/1 and 9/30/95
C 364 Sale: to be advertised between 7/1 and 9/30/95

Determination of Affect: not likely to adversely effect

KISATCHIE HMA

Leesville 69, 70, 71 Sale, C 69, 70, 71: sold
Willamette 3 Sale, C 3: sold
PBS 62, 63, 64 Sale, C 62, 63, 64: sold
C 33 Sale: to be advertised by 7/1/95
C 30 Sale: to be advertised by 7/1/95

Determination of Affect: not likely to adversely effect

VERNON HMA

There are no sales sold or planned that are outside of 3/4 mile radius circles.

Determination of Affect: not likely to adversely effect

WINN HMA

IP 58 Sale, C 58: sold
LP 50 Sale, C 50: sold
Nix 66 Sale, C 66: sold
PBS 63, 64 Sale, C 63, 64: sold
Riverwood 113 Sale, C 113: sold
Riverwood 20 Sale, C 20: sold
PBS 6 Sale, C 6: sold
Willamette 5 Sale, C 5: sold

TIMBER SALE APPENDIX

WINN HMA cont.

Dobson 26, 36 Sale, C 26, 36: sold
Dobson 39 Sale, C 39: sold
C 103 Sale: to be advertised by 7/1/95

Determination of Affect: not likely to adversely effect

NATIONAL FORESTS IN MISSISSIPPI

BIENVILLE HMA

C 280 Sale: sold
C 277 Sale: sold
C 212, 214 Sale: sold
C 263 Sale: sold
C 242, 272 Sale: sold
C 275, 276 Sale: sold
C 4 Sale: sold
C 10, 12, 66 Sale: sold
C 97, 99 Sale: sold
C 42, 43, 55 Sale: sold
TVA ROW Sale, C 17, 19, 20, 23, 33: sold
C 225 Sale: to be advertised by 7/1/95
C 261, 262 Sale: to be advertised by 7/1/95
C 204, 205, 220 Sale: to be advertised by 7/1/95
C 70, 71 Sale: to be advertised between 7/1 and 9/30/95
C 30, 37 Sale: to be advertised between 7/1 and 9/30/95

Determination of Affect: not likely to adversely effect

BILOXI HMA

C 518, 521 Sale: sold
C 526, 527 Sale: sold
C 510, 512, 513 Sale: sold
C 526 Sale: sold
C 551, 553 Sale: sold
C 550, 554, 555 Sale: sold
C 566, 567 Sale: sold
C 511, 514 Sale: to be advertised by 7/1/95
C 518, 519, 528 Sale: to be advertised by 7/1/95
C 558, 563, 615 Sale: to be advertised by 7/1/95
C 528 Sale: to be advertised between 7/1 and 9/30/95

Determination of Affect: No effect

TIMBER SALE APPENDIX

BLACK CREEK HMA

C 287 Sale: sold
C 68, 69, 83 Sale: sold
C 81, 82 Sale: to be advertised by 7/1/95
C 249, 251 Sale: to be advertised by 7/1/95
C 21, 22 Sale: to be advertised between 7/1 and 9/30/95
C 50 Sale: to be advertised between 7/1 and 9/30/95

Determination of Affect: No effect

CHICKASAWHAY HMA

Hankins 406, 408 Sale, C 406, 408: sold
Gulf Lumber 341 Sale, C 341: sold
GA Pacific 354, 358, 360 Sale, C 354, 358, 360: sold
Hankins 364, 377, 408 Sale, C 364, 377, 408: sold
Conway 340, 380 Sale, C 340, 380:sold
Hood Ind. 371, 411 Sale, C 371, 411: sold
Hood Lbr. 382, 356 Sale, C 382, 356: sold
Hood Ind. 397, 401 Sale, C 397, 401: sold
Hood Ind. 426, 428 Sale, C 426, 428: sold
C 413, 445 Sale: to be advertised by 7/1/95
C 410, 418 Sale: to be advertised by 7/1/95
C 400, 405 Sale: to be advertised by 7/1/95
C 342 Sale: to be advertised by 7/1/95

Determination of Affect: not likely to adversely effect

HOMOCHITTO HMA

C 260 Sale: sold
C 302, 315 Sale: sold
C 239, 253, 254 Sale: sold
C 272 Sale: sold
C 306 Sale: sold
C 293, 273, 309, 320 Sale: sold
C 83 Sale: sold
C 79 Sale: sold
C 288 Sale: to be advertised by 7/1/95
C 286 Sale: to be advertised by 7/1/95
C 299 Sale: to be advertised by 7/1/95

Determination of Affect: not likely to adversely effect

TIMBER SALE APPENDIX

OUACHITA NATIONAL FOREST

OUACHITA HMA

C 323, 325 Sale: sold
C 323, 324 Sale: sold
C 326, 327 Sale: sold
C 821, 822, 832 Sale: sold
C 1243 Sale: sold
C 1253 Sale: sold
C 1254, 1267 Sale: sold
C 1264, 1275 Sale: sold
C 1242, 1244 Sale: sold
C 1238 Sale: sold
C 1256, 1257 Sale: sold
C 1271 Sale: to be advertised by 7/1/95
C 1288, 1289: to be advertised by 7/1/95
C 1286 Sale: to be advertised between 7/1 and 9/30/95

Determination of Affect: No effect

NATIONAL FORESTS IN NORTH CAROLINA

CROATAN HMA

Flanners Beach Sale, C 9: sold
Mundine Sale, C 12, 58: sold
Croatan Sale, C 8: to be advertised between 7/1 and 9/30/95
Long Point Sale, C 39, 40: to be advertised between 7/1 and 9/30/95
Farrier Farm Sale, C 3, 4: to be advertised between 7/1 and 9/30/95
Billfinger Sale, C 18: to be advertised between 7/1 and 9/30/95

Determination of Affect: not likely to adversely effect

FRANCIS MARION/SUMTER NATIONAL FOREST

FRANCIS MARION HMA

C 71, 81 Sale: sold
C 51, 54 Sale: sold
C 57, 74 Sale: sold
C 40, 45, 46 Sale: sold
C 26, 76 Sale: sold
C 15 Sale: sold
C 45, 46, 63 Sale: sold
C 183, 185 Sale: sold
C 180, 182 Sale: sold
C 178, 179 Sale: sold
C 148, 149 Sale: sold
C 146 Sale: sold
C 138 Salvage Sale: sold

TIMBER SALE APPENDIX

FRANCIS MARION HMA cont.

C 138 Thinning Sale: sold
C 130 Sale: sold
C 139 Sale: to be advertised by 7/1/95
C 174 Sale: to be advertised by 7/1/95
C 141, 143, 144 Sale: to be advertised by 7/1/95
C 84, 96, 99, 102, 108 Sale: to be advertised by 7/1/95
C 38, 40, 47, 62 Sale: to be advertised by 7/1/95
C 120, 122, 123, 140 Sale: to be advertised by 7/1/95
C 15, 16, 17 Sale: to be advertised by 7/1/95
C 166, 168, 170 Sale: to be advertised between 7/1 and 9/30/95
C 26, 35, 37 Sale: to be advertised between 7/1 and 9/30/95
C 157 Sale: to be advertised between 7/1 and 9/30/95

Determination of Affect: not likely to adversely effect

NATION FORESTS IN TEXAS

ANGELINA/SABINE HMA

C 113 Sale: sold
C 61 DbD Sale: sold
C 119, 120 Sale: to be advertised by 7/1/95
C 133, 134, 137 Sale: to be advertised by 7/1/95
C 89, 90, 91 Sale: to be advertised between 7/1 and 9/30/95

Determination of Affect: not likely to adversely effect

DAVY CROCKETT HMA

C 6A Sale: sold
C 9, 10, 11 Sale: sold
C 29 Sale: sold
C 31 Sale: sold
C 43 Sale: sold
C 43A Sale: sold
C 56 Sale: sold
C 66 Sale: sold
C 55 Sale: to be advertised by 7/1/95

Determination of Affect: not likely to adversely effect

SAM HOUSTON HMA

C 101 Thin Sale: sold

C 71 1200m Sale: sold
C 80, 83 Sale: sold
Big Woods DbD Sale: sold
Southern DbD Sale: to be advertised between 7/1 and 9/30/95

TIMBER SALE APPENDIX

SAM HOUSTON HMA cont.

Jayhawker Sale, C 120, 123, 124: to be advertised between 7/1 and 9/30/95

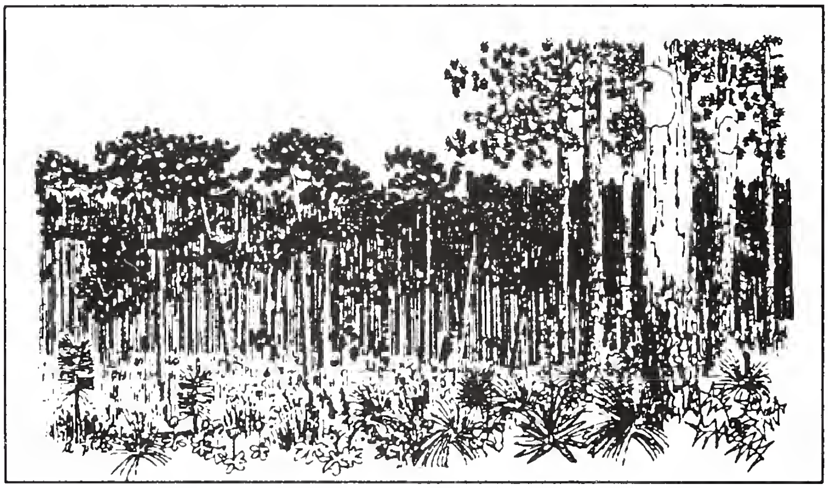
Determination of Affect: not likely to adversely effect

U.S. FISH AND WILDLIFE SERVICE

Biological Opinion
on

The U.S. Forest Service

ENVIRONMENTAL IMPACT STATEMENT FOR THE MANAGEMENT OF THE RED-COCKADED WOODPECKER AND ITS HABITAT ON NATIONAL FORESTS IN THE SOUTHERN REGION



Prepared By:

RALPH COSTA
Red-Cockaded Woodpecker Recovery Coordinator
MAY 1, 1995

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Red-cockaded Woodpecker Field Office
Department of Forest Resources
Clemson University
261 Lehotsky Hall, Box 341003
Clemson, South Carolina 29634-1003

IN REPLY REFER TO

May 1, 1995

Robert C. Joslin, Regional
Forester
USDA, Forest Service
1720 Peachtree Road, NW
Atlanta, Georgia 30367

Dear Mr. Joslin:

This biological opinion responds to the U.S. Forest Service's (Forest Service) request (letter and Biological Assessment dated September 2, 1994) for formal consultation with the U.S. Fish and Wildlife Service (Service) pursuant to Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531-1543). This document represents the Service's biological opinion on the effects of the Forest Service's selection of Alternative E (as identified in both the Final Environmental Impact Statement for the Management of the Red-cockaded Woodpecker and its Habitat on National Forests in the Southern Region [EIS] and the Biological Assessment for the EIS), on the Red-cockaded Woodpecker (RCW) in accordance with the Section 7 Interagency Cooperation Regulations 50 CFR Section 402 et seq..

The EIS is considered a general programmatic planning document that establishes criteria to delineate RCW habitat management areas, determine population objectives, and identify standards and guidelines under which project level activities (e.g., prescribed burning, timber harvest, pine restoration) may be planned and implemented to carry out the management direction of the EIS. This new landscape management approach to RCW conservation on national forest lands would be implemented on each affected Forest when incorporated into individual Forest Land and Resource Management Plans by amendment and/or revision. Therefore, this biological opinion does not evaluate the effects of the proposed action at the project level. All project level activities will undergo separate National Environmental Policy Act (NEPA) review when proposed, as well as a review under section 7 of the ESA. Thus, no irreversible or irretrievable commitment of forest resources is made in the EIS, but rather at the point in time when a particular activity/program is proposed and undergoes its own NEPA and

section 7 reviews and a decision notice or record of decision is signed. This regional EIS will set out management direction that is adjustable through monitoring and evaluation, amendment and revision.

This biological opinion refers only to the potential affects on the RCW and is based on information provided in/by the EIS and biological assessment; telephone conversations, meetings, and correspondence between our agencies; scientific literature (published, in press, in review, and in preparation); personal communication with knowledgeable scientists, researchers, land managers, and biologists; other data sources (published and unpublished); and personal knowledge of Service biologists. A complete administrative record of this consultation is on file in our Clemson, South Carolina field office.

Based on information available to the Service, including the EIS, biological assessment, data supplied by various Service field offices, and scientific literature, we concur with the Forest Service's determination of effect that the proposed action, identified as alternative E in the EIS, will not adversely affect the following listed species:

<u>Plants</u>

Pigeon Wings (<u>Clitoria fragrans</u>)
Apalachicola Rosemary (<u>Conradina glabra</u>)
Scrub Buckwheat (<u>Eriogonum longifolium</u> var. <u>gnaphalifolium</u>)
Harper's Beauty (<u>Harperocallis flava</u>)
Pondberry (<u>Lindera melissifolia</u>)
Rough-leaved Loosestrife (<u>Lysimachia asperulaefolia</u>)
White Birds-in-a-Nest (<u>Macbridia alba</u>)
Britton's Beargrass (<u>Nolina brittoniana</u>)
Godfrey's Butterwort (<u>Pinguicula ionantha</u>)
Lewton's Polygala (<u>Polygala lewtonii</u>)
Chaffseed (<u>Schwalbea americana</u>)
Florida Skullcap (<u>Scutellaria floridana</u>)
Navasota Ladies'-Tresses (<u>Spiranthes parksii</u>)
Gentian Pinkroot (<u>Spigellia logamiodes</u>)
Michaux's Sumac (<u>Rhus michauxii</u>)

<u>Mammals</u>

Red Wolf (<u>Canus rufus</u>)
Florida Panther (<u>Felis concolor coryi</u>)
Eastern Cougar (<u>Felis concolor couguar</u>)
Gray Bat (<u>Myotis grisescens</u>)
Indiana Bat (<u>Myotis sodalis</u>)
Virginia Big-eared Bat (<u>Plecotus townsendii virginianus</u>)
Louisana Black Bear (<u>Ursus americanus luteolus</u>)

Birds

Peregrine Falcon (Falco peregrinus)
Mississippi Sandhill Crane (Grus canadensis pulla)
Bald Eagle (Haliaeetus leucocephalas)

Reptiles

Eastern Indigo Snake (Drymarchon carais couperi)
Blue-tailed Mole Skink (Eumeces egregius lividus)
Sand Skink (Neoseps reynoldsi)
Gopher Tortoise (Gopherus polyphemus)

Insects

American Burying Beetle (Nicophorus americanus)

The "will not adversely affect" determination for the above listed species is based on an analysis of the effects of the actions at a landscape/regional scale. This biological opinion does not evaluate the effects of proposed actions at the stand/Forest level. The effects at the stand/Forest level on listed species must be consulted on with the Service, during development of National Forest Land and Resource Management Plans and project level plans as appropriate.

CONSULTATION HISTORY

During the 43-month period covered by the following consultation history, dozens of phone calls (an average of 1-3/month) between the Service and Forest Service took place. Many of these, particularly during the period from 1991 to late 1994) are not recorded in this consultation history. The most important issues regarding this consultation were discussed at meetings between the respective agencies or were covered/"discussed" through the mail or via fax correspondence; these are listed in the consultation history.

By letter dated May 3, 1991, the Forest Service requested review and comment on the LTS from all Forest Supervisors and District Rangers in the Southern Region of the Forest Service; this same letter was mailed along with the LTS to the RCW Coordinator.

By letter dated May 7, 1991, the Forest Service mailed an "errata sheet" for the LTS to the RCW Coordinator.

Pursuant to a June 1991 phone call, the Forest Service requested that the newly selected (reporting date of August 12, 1991) Service RCW Recovery Coordinator (RCW Coordinator) review and comment on the first draft of the new Long-Term

RCW Management Strategy (LTS).

On July 21, 1991, the RCW Coordinator provided comments (via the Forest Service Data General [DG] mail system), to the Forest Service regarding the LTS. Comments covered timing of the strategy, RCW "only" concept, public credibility, silvicultural practices, foraging habitat requirements, habitat management area (HMA) concept, population objective calculations, rotation ages, potential cavity tree retention guidelines, management intensity level concept, critical recovery issues, and process options of finalizing, approving, and implementing the new RCW strategy.

By letter dated July 26, 1991, the Forest Service provide the RCW Coordinator minutes of a July 24-25, 1991 meeting concerning the development of alternatives for the LTS.

By DG mail correspondence dated August, 1991, the RCW Coordinator provided additional comments on the LTS to the Forest Service. Comments covered habitat management area boundary delineation, private lands and sub-populations, management intensity levels and small populations, and foraging habitat calculations.

In August, 1991, the Forest Service requested via a phone call, and the RCW Coordinator responded via the DG mail system, information pertaining to road management in RCW clusters.

On August 15, 1991, Forest Service and Service officials met to discuss the LTS. Primary issue discussed was the habitat management area concept.

By DG mail correspondence dated August 29, 1991, the Service received from the Forest Service internal communications concerning relic tree availability under different rotation ages.

In September, 1991, the Service received from the Forest Service notes and memos (dated August 7, 28, and September 3, 1991) from a Forest Service RCW researcher regarding cavity tree ages and future potential cavity tree availability with different rotations.

On September 5, 1991, the Service received from the Forest Service, via fax, a RCW Long-Term Management Tentative Preferred Alternative. This alternative outlined all aspects of RCW management, including silviculture, population objectives, habitat management areas, management intensity levels, foraging habitat, monitoring, artificial cavities, and augmentation.

Via fax on September 13, 1991, the Forest Service sent the Service information concerning cavity tree ages on the Apalachicola National Forest and the Vernon Ranger District, Kisatchie National Forest.

By DG mail correspondence dated September 18, 1991, the Service received from the Forest Service internal communications regarding the known ages of RCW cavity trees on the Apalachicola National Forest. These data were being analyzed to help determine what age trees would be needed to provide potential RCW cavity trees.

On September 18, 1991, the Forest Service provided the Service additional internal DG communications concerning the number of potential RCW cavity trees that would be available under different rotation ages and management strategies (replacement and recruitment stands). Also on this date, via the DG system, the Forest Service provided the Service a second draft of the RCW Long-Term Management Tentative Preferred Alternative.

On September 23, 1991, the Forest Service provided the Service with internal communications regarding the frequency of red-heart disease and its relationship to tree age.

By DG mail dated September 26, 1991, the Forest Service provided the Service a draft (the third) of the RCW Long-Term Management Alternative E (previously referred to as the Tentative Preferred Alternative).

By letter dated October 29, 1991, and received November 1, 1991 by the Service, the Forest Service requested public comments on RCW Management Strategy Key Elements and the process of how the new strategy will be developed and implemented. Also on October 29, 1991, the Forest Service published in the Federal Register a Notice of Intent (NOI) to prepare an environmental impact statement for management direction for the RCW in the Southern Region.

By letter dated November 5, 1991, the Director of Environmental Affairs, DOI informed the Director of the Service of the NOI and requested that comments be made, if needed and appropriate, to the Forest Service by November 29, 1991.

On November 13, 1991, Forest Service and Service officials met on the Oconee National Forest to discuss implementation of new RCW management direction on Forest Service units that currently have very small numbers of RCWs, but are designated recovery populations with high population objectives. This meeting and additional conversations and analysis lead to the development of the sub-HMA concept.

By letter dated November 25, 1991, the Service's Regional Director, Region 2, provided comments on the NOI (10/29/91) to the Service's Director.

By letter dated November 27, 1991, the Service's Regional Director, Region 4, also provided comments on the NOI to the Service's Director.

By letter dated December 2, 1991, the Forest Service requested the Service to become cooperators (per 40 CFR 1501.6) in the development of the RCW EIS and new management guidelines.

On December 11, 1991, the Services Washington Office, Division Of Endangered Species, provided consolidated Service comments regarding the NOI to the Forest Service. Comments included: (1) a request that when considering economic effects on local communities with the implementation of each alternative, the Forest Service also place these economic projections within a historical context, (2) the need for a southern pine beetle/RCW foraging habitat loss analysis, and (3) a suggestion to define RCW corridor size.

By letter dated January 17, 1992, the Service agreed to become a cooperator with the Forest Service as requested on 12/2/91.

On March 20, 1992, the Service received from the Forest Service internal DG mail correspondence (dated March 18, 1992) concerning the key points of discussion for the 3/23/92 Forest Service and Service meeting. Topics included rotation ages, habitat management area delineation and minimum size, fragmentation, and retention of relics.

On March 23-24, 1992, Forest Service and Service officials met to discuss the key points identified in the March 18, 1992 DG memo. Additionally, details regarding rotation ages and their relationship to red heart disease, foraging habitat quality, population density, and cavity tree preference were discussed. The Service provided hand written notes to the Forest Service on the topics covered in the memo.

On March 30, 1992, the Service received, via DG mail, internal Forest Service correspondence regarding a new proposed alternative (Alternative F) for the RCW EIS. Topics covered included fragmentation control, augmentation, rotation ages, and RCW dispersal; an outline of the alternative, similar to previous copies of the preferred alternative, was also provided.

By letter dated August 4, 1992, the Forest Service provided the Service a new management option for loblolly pine designed primarily to be used in high risk southern pine beetle areas.

On August 6, 1992, via DG mail, the Service received from the Forest Service, a supplement to the loblolly pine option. The information provided examined the effects of rotation length and regeneration methods on RCW nesting and foraging habitat; and included a description of the modeling and analysis used.

On August 10, 1992, the Service received internal DG mail correspondence (dated August 7, 1992) from the Forest Service regarding what selection criteria would be appropriate for choosing various silvicultural options, given that all options appear to provide adequate quantities of cavity trees and foraging habitat.

On December 9, 1992, the Service received (via DG mail) a request for thoughts/ideas on the relationship between existing foraging habitat requirements and the potential for southern pine beetle problems given lengthened rotation ages and recommended tree spacing requirements to reduce southern pine beetle hazards.

On December 12, 1992, the Service received a fax from the Forest Service requesting thoughts and comments on a change to Alternative E that would address the southern pine beetle hazard reduction conflict with providing the "required" foraging habitat.

On January 8, 1993, Forest Service and Service officials met to discuss current status and content (alternatives) of the RCW EIS. Additionally, time lines and implementation procedures were covered.

Based on a February, 1993 phone request from the Service, on February 9, 1993, the Forest Service provided a list of the total acres, total suitable RCW acres, and the tentative habitat management area acreage for all RCW populations (27).

On May 26, 1993, the Forest Service provided the Service (via fax) internal comments on RCW density objectives (clusters/unit area).

By letter dated July 30, 1993, the Forest Service informed the Service that they expected to complete the Draft EIS (DEIS) for the RCW and its habitat on National Forests in the Southern Region by the end of the fiscal year. The Forest Service indicated that they would request formal consultation on the preferred alternative and concurrence on the

determination of effect for the other alternatives.

By letter dated December 10, 1993, the Forest Service requested Service Field Office comments on their RCW DEIS.

Based on a January, 1994 phone request from the Service, on February 1, 1994, the Forest Service faxed histograms of RCW population trends for all RCW populations in the Southern Region.

In March, 1994, the Forest Service provided the Service internal comments (dated February 14, 1994 and March 1, 1994), from Forest Service RCW researchers, on the RCW DEIS.

In response to the December 1, 1993 RCW DEIS comments request from the Forest Service, 3 Service offices provided comments on the RCW DEIS: by letter dated March 22, 1994, the Regional Director, Region 2 submitted comments; on March 23, 1994, the Services Brunswick, Georgia Field Office provided comments; and on April 26, 1994, the Services Raleigh, North Carolina Field Office submitted comments.

On May 4, 1994, Forest Service officials and the Services RCW Coordinator met to discuss recent Service Field Office comments on the RCW EIS and additional concerns and comments of the RCW Field Office (Clemson, South Carolina).

Based on a May, 1994 phone request from the Service, on May 25, 1994, the Forest Service provided an update on the current status (December 9, 1993 through March 15, 1994) of the Texas RCW court case.

On September 2, 1994, the Forest Service submitted a biological assessment to the Service and requested formal consultation on the management of the RCW and its habitat on National Forests in the Southern Region.

On September 15, 1994, the Services Assistant Regional Director, Region 4 requested review of, and comments on, the biological assessment from all Field Supervisors, Southeast Region and appropriate Field Supervisors in Region 2.

In response to the above request, 6 Service Field Offices provided comments on the biological assessment: the Raleigh, North Carolina Field Office re-submitted their April 26, 1994 comments on the RCW DEIS; on October 5, 1994, the Daphne, Alabama Field Office provided comments; on October 12, 1994, the Brunswick, Georgia Field Office submitted comments; the Charleston Field Office submitted comments on October 14, 1994; the Asheville, North Carolina Field Office provided input on October 18, 1994; and, the Clear Lake Field Office (Region 2) provided comments on October 31, 1994.

On November 14, 1994, the Forest Service and Service met to discuss Service Field Office comments on the biological assessment and the current status of the RCW EIS. The Forest Service presented the Service with the latest version of the EIS; the last version given to the Service was dated December 1993. Service consultation and RCW EIS time frames and completion dates were established. Discussions included clarification of several of the more important issues raised during the RCW DEIS comment period, including: (1) delaying regeneration of the oldest 1/3 of the suitable acres until rotation age, (2) potential RCW habitat losses outside the 3/4 mile zones, but within the habitat management area boundaries, during the period between signing of the RCW EIS Record of Decision and final approval of individual Forest plan revisions/amendments, (3) Service consultation requirements after final approval of Forest plan revisions and amendments. The Forest Service also mentioned a proposal to increase the flexibility of foraging habitat guidelines for Forests with small populations and/or many acres of habitat to restore. The Service requested additional information regarding Forest rotation ages, translocation records, forest regulation information concerning delaying regeneration in the oldest 1/3 of the suitable acres, and the Forest's planning time lines, from the Forest Service needed to prepare the biological opinion.

Via courier on November 15, 1994, the Service received the additional information requested on November 14, 1994. By fax on this same date, the Service requested additional information from the Forest Service concerning Forest age class distributions for HMAs and, if available, outside the 3/4 mile zones but within the HMAs.

On November 21, 1994, during a phone conversation with the Service, the Forest Service confirmed that no decisions had been made yet regarding the foraging habitat proposal discussed on November 11, 1994.

On November 29, 1994, the Service contacted the Forest Service to inquire about the foraging habitat proposal and to recommend a mutually agreed upon extension of the consultation period. The Forest Service informed the Service that no changes in foraging habitat guidelines would be proposed at this time and that an extension of the consultation period would be discussed with other officials.

On December 29, 1994, The Service received the age class distribution data requested from the Forest Service on November 15, 1994.

On January 4, 1995, a conference call between the Service and Forest Service was held. Discussion topics included, the incomplete status of the RCW DEIS, additional information required by the Service, and a mutually agreed upon time frame for completing the consultation. Agencies decided that, pending timely receipt by the Service of additional information requested (HMA maps and acreage), and no other data needs, the draft biological opinion would be provided to the Forest Service on January 20, 1995, with a final on February 10, 1995.

On January 5, 1995, the Service received 2 faxes from the Forest Service containing the information requested on January 4, 1995.

On January 6, 1995, the Service called the Forest Service to discuss numerous issues (16 total) concerning the EIS. Topics included, foraging habitat guidelines, MIL 3 and Sub-HMAs, monitoring standards, snag policies, harvesting restrictions in tentative HMAs outside 3/4 mile zones from the date of EIS approval to Forest Plan amendments/revisions are completed (i.e., 1-3 years), schedules for population objective attainment, single tree selection in longleaf, "likely to adversely effect" determination for Alternative D, EIS coverage of effective population discussion, retention of trees in MIL 1, the loblolly/SPB exception policy, and the Oconee NF population objective.

Via fax on January 7, 1995, the Service sent its notes from the 1/6/95 phone conversation and requested additional information regarding, percentage of HMAs in the 0-10 and 0-30 age classes by species and management types, effective and Forest Plan rotation ages, acres harvested since Interim S&Gs (1990) was implemented through 1994, and the current (1994) number of active clusters in the action area.

Via fax on January 10, 1995, the Service received from the Forest Service new proposed language regarding foraging standards for: (1) HMAs with sparse RCW populations and (2) situations requiring extensive restoration acres.

Via fax on January 12, 1995, the Service received from the Forest Service 2 faxes pertaining to, and illustrating the challenges of (regarding foraging habitat requirements), longleaf restoration on 2 National Forests.

On January 18, 1995, the Service called the Forest Service to inform them that the draft biological opinion would not be forthcoming on 1/20/95 because the information requested by the Service on 1/7/95 had not yet been received. The Service suggested that if the data was received by 1/20/95, a draft opinion could possibly be available (depending on what

analyses had to be done with the data) by 1/30/95. It was mutually agreed that the draft biological opinion should essentially be in final form before being issued, with the possible exception of the "other species" (i.e., non-RCW) and literature cited sections, and therefore providing it on 1/20/95 in its current form would not be appropriate.

On January 25, 1995, the Forest Service phoned the Service to inquire if the biological opinion would be available by 1/30/95. The Service noted that the data requested on 1/7/95 had still not been received and stated that the biological opinion could not be issued until all data was received and considered. The Service requested the Forest Service's regional RCW annual reports for 1993 and 1994, which could not be located in the Services' files. The Forest Service indicated that those reports had not been completed, but that the data requested (injury/mortality numbers) would be forthcoming. The Forest Service indicated that a draft copy of the EIS Implementation Guide would be mailed to the Service.

On January 30, 1995, the Service and Forest Service discussed by telephone, when the draft biological opinion might be ready. The Service suggested that, depending on what form the data requested on 1/7/95 (and not yet delivered) was received in, the draft opinion could possibly be available the week of 2/6/95. The Service also reminded the Forest Service that information regarding proposed foraging habitat guidelines changes had not yet been provided to the Service; and, final resolution of all issues discussed since 11/14/94 had not been reached, and the Service has not seen a final copy of the EIS reflecting the many changes discussed during this time period.

Via FedX delivery on February 1, 1995, the Service received the data requested on 1/7/95. On this date, via fax, the Service received corrected data, pertaining to the 1/7/95 request, for the National Forest's in Texas. Also on this date, the Service received data from the National Forests in Florida regarding the number of stands on the Apalachicola Ranger District (ARD) less than 30 years old.

On February 2, 1995, the Service received, via U.S. Postal Service a copy of the draft EIS Implementation Guide. Via fax on this date, the Service also received RCW injury/mortality information for 1993/1994, as requested on 1/25/95.

On February 3, 1995, the Service phoned the Forest Service to clarify various points, and ask additional questions, regarding specific issues in the EIS; topics included, regeneration in the oldest 1/3 of the suitable acres, number

of populations in the action area, MIL 3 and Sub-HMAs, and other, as yet unresolved concerns in the EIS, originally discussed on 1/6/95. It was agreed that the Forest Service would provide the Service an updated copy of the EIS, with all changes (since the version supplied on 11/14/94) highlighted, on February 6, 1995. Additionally, the agencies agreed to set a new timeframe for the issuance of the draft and final biological opinion, given that the final would not be available on 2/10/95 as previously agreed upon. Also on this date, via fax the Service received the Forest Service's 1994 regional population estimate for the number of active clusters.

On February 7, 1995, the Forest Service phoned the Service to inform them that the latest version of the EIS was not ready for delivery on February 6, 1995, but would be FedX'ed to the Service on February 9 or 10, 1995. It was agreed that new dates for delivery of the draft and final biological opinion to the Forest Service would be set, via phone, on February 9 or 10, 1995.

On February 8, 1995, the Service requested via fax, from the Apalachicola Ranger District, Apalachicola National Forest, RCW effective population size information for 1993 and 1994

On February 9, 1995, the Service received via fax, data from the Apalachicola Ranger District regarding effective population sizes for 1993 and 1994. Also on this date during a phone conversation between the Service and the Forest Service, the Service was informed that the Final EIS would not be available on 9 or 10 February, but would be Fedx'ed to the Service the following week. Later that day the Service received a draft letter, via fax, from the Forest Service indicating a final biological opinion date of March 10, 1995. The Service phoned the Forest Service to renegotiate the final date (due to the RCW Coordinator's travel schedule) to March 17, 1995; both agencies agreed on this date.

Via fax on February 10, 1995, the Service received additional information from the Apalachicola Ranger District regarding RCW effective population sizes for 1993 and 1994.

Via fax on February 13, 1995, the Service received a copy of the letter from the Forest Service to the Service establishing March 17, 1995 as the date for receipt of the final biological opinion.

On February 14, 1995, the Service received a fax from the Forest Service regarding RCW handling activities for 1993 and 1994. Also on this date, the Service received a fax from the Forest Service regarding the adult translocation mortality on the Daniel Boone National Forest.

On February 15, 1995, the Service received via fax from the Forest Service, written clarification on how the 16 issues, raised by the Service and discussed with, and faxed to, the Forest Service on January 6, 1995 would be addressed in the Final EIS.

On February 16, 1995, the Service received (via FEDX) the latest revision of the DEIS.

On February 17, 1995, the Croatan National Forest, at the request of the Service (via phone) faxed the Service information concerning nestling mortalities suffered during a wildfire in the summer of 1994. Also on this date the Service phoned the Forest Service to clarify several issues, including wilderness clusters, timing for regeneration in the oldest 1/3 of the pine type, and RCW cluster information and timber harvesting for the Bienville National Forest.

On February 27, 1995, the Forest Service faxed the Service information regarding age class distributions and RCW HMA acreage for the Bienville and Chickasawhay HMAs.

On March 1, 1995, the Forest Service faxed the Service clarifying language for the RCW EIS regarding the following issues; restoration and landscape constraints to avoid adverse impacts to RCWs, modification of foraging guidelines to expedite restoration efforts, and fine tuning Forest population objectives based on land type associations.

On March 2, 1995, via a conference call with Forest Service staff, the Service discussed the issue of how to deal with sold and ongoing timber sales after the EIS and Record of Decision (ROD) are issued and signed. It was agreed that final decisions on this topic would be made after the magnitude of situation was better understood by the Forest Service.

On March 13, 1995, the Forest Service informed the Service, via phone, that the Forest data on sold and ongoing timber sales would not be available until March 31; therefore a second consultation extension was agreed upon, with a new date to be established by March 17.

On March 16, 1995, the Service and Forest Service, via phone, mutually agreed to extend the consultation until April 21, 1995.

Via fax on March 20, 1995, the Service received a letter from the Forest Service extending the consultation period until April 21, 1995.

Via fax on April 6, 1995, the Forest Service provided the Service a proposal on how to deal with future (post-signing of ROD and pre-completion of Forest Land and Resource Management Plans) section 7 project consultations. On this same date the Forest Service faxed the Service their response (2 page letter) to the Draft RCW Biological Opinion.

Via U.S. Postal Service on April 10, 1995, the Service received from the Forest Service the 2 page letter faxed on 4/6/95, 14 pages of specific comments on the Draft RCW Biological Opinion, and a Supplement to the original Forest Service Biological Assessment for the RCW EIS. The supplement addressed 2 additional listed plant species and the issue of sold and ongoing timber sales.

On April 12, 1995, the Service and Forest Service discussed, via phone, the need to extend the consultation process beyond April 21, due to the arrival date (April 10) of the Forest Services' comments on the Draft RCW Biological Opinion and prior commitments of the Services RCW Coordinator that precluded completion of the Opinion by April 21.

Via fax on April 14, 1995, the Forest Service provided the Service various graphs of the regional Forest Service RCW population since 1986.

Via Federal Express on April 13, 1995, the Service received from the Forest Service a Draft ROD and a Draft Appendix A to the ROD (RCW Management Direction Standards and Guidelines).

Via phone conversation on April 21, 1995, the Forest Service and Service mutually agreed to extend the consultation period until May 1, 1995. On this same date the Forest Service faxed the Service a letter extending the consultation to May 1, 1995.

On April 24, 1995, the Service requested information from the Forest Service regarding the number of cavity trees cut down because of southern pine beetle infestations. On this same date the Forest Service, via phone, responded with the information.

On April 26, 1995, the Forest Service faxed the Service additional information on cavity trees cut because of southern pine beetle infestations. Also on this date the Service received from the Forest Service the hard copy of the latest consultation extension letter.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

The Forest Service proposes to revise the Regional Wildlife Habitat Management Handbook (2609.23R), amend the Southern Regional Guide, and amend affected Forest Plans with new management direction for the endangered RCW. The proposed action has several elements and levels of implementation. The revised Handbook/Regional Guide Amendment would establish criteria to delineate RCW HMAs and determine population objectives and establish standards and guidelines for management within HMAs. Elements of this direction would be implemented on each affected National Forest either now or when incorporated into Forest Plans by amendment or revision (within 3 years).

Because of the time lag between the revised Handbook and Regional Guide amendment and the subsequent individual Forest Plan amendments or revisions, the Forest Service proposes to immediately amend the relevant Forest Plans to designate tentative HMAs in the Record of Decision (ROD). These Forest Plan amendments designating tentative HMAs would require certain specific management practices to conserve the RCW and avoid jeopardy to the species; they would remain in place until superseded by the individual Forest Plan amendments or revisions that will incorporate the revised Handbook/Regional Guide direction.

The Forest Service through its planning process has identified five alternatives that it has considered in an attempt to determine its new management direction for the RCW. The preferred alternative identified by the Forest Service is Alternative E.

Alternative E is based on the establishment of HMAs and rotation lengths ranging from 70 to 120 years. Rotations are based on research on the rate of heartwood development in longleaf and loblolly pine, and analysis of the age of existing cavity trees. Alternative E establishes four management intensity levels (MILs) and stresses the use of fire, including growing season burns, to control midstory vegetation.

The proposed action would set into motion both an immediate and a deferred set of actions, each containing various elements. These actions and elements are summarized in this section.

The following National Forests contain RCW HMAs and are included within the action area for this biological opinion:

Alabama	Bankhead Conecuh Talladega
Arkansas	Ouachita
Florida	Apalachicola Ocala Osceola
Georgia	Oconee/Hitchiti
Kentucky	Daniel Boone
Louisiana	Kisatchie
Mississippi	Bienville Desoto Homochitto
N. Carolina	Croatan
S. Carolina	Francis Marion
Tennessee	Cherokee
Texas	Angelina/Sabine Davy Crockett Sam Houston

(1) Habitat Management Area Delineation

The establishment of HMAs is an integral part of Alternative E. The Forest Service proposes to delineate HMAs for all active RCW populations dependent on National Forest lands. The three National Forests that had RCWs in the past 20 years but have none at present, would decide whether to develop HMAs and actively manage reintroduced support populations. This decision would be deferred until the Forests revise their Forest Plans.

An individual HMA, tentative or permanent, would include sufficient acres of suitable habitat, foraging and nesting, to support at least 50 RCW groups. Recovery populations would have HMAs large enough to support 500 groups, if the land base will allow. Suitable RCW habitat includes pine and pine/hardwood forest types which have the potential to provide at least minimal RCW foraging habitat. The

delineation of HMAs is further discussed in the EIS.

(2) Delineation of Tentative HMA Boundaries

Full implementation of the new Regional RCW management direction may be delayed for two or more years due to the time necessary to complete Forest Plan revisions/amendments. Interim Standards and Guidelines for the Protection and Management of RCW Habitat within 3/4 Mile of Colony [Cluster] Sites (Interim S&Gs) (USDA 1990) currently protect 3/4-mile radius circles around existing active and inactive clusters, but do not affect habitat outside the circles which would become part of the permanent HMA. Silvicultural actions allowed within the tentative HMAs would include thinnings, and two-aged or uneven-aged management that retains at least 40 square feet of basal area. The retention of this number of trees will allow a wide range of silvicultural options in the future. Clearcutting also would be allowed if done to restore longleaf or other desirable pine species on appropriate sites, provided that recruitment stands and foraging habitat have been identified to meet a Forest's tentative population objective. These silvicultural options apply to the areas within the tentative HMA but outside the 3/4-mile radius circles. Forest Plan rotations, allowable sale quantities, etc., within these areas, will not be changed at this time. Any such changes will occur when the individual Forest Plans are revised/amended.

Tentative HMAs would be delineated using the process detailed in Appendix A of the EIS. The boundaries would be finalized as a part of the Forest Plan amendment/revision to incorporate the new Regional RCW management direction.

(3) Setting Population Objective

The Forest Service proposes to establish tentative population objectives in the EIS, and final objectives for each HMA in the Forest planning process. Permanent population objectives are determined after the permanent HMA has been delineated in Forest plans and are based on the area of suitable RCW habitat within each HMA. Appendix A of the EIS presents a detailed description of this process. The Service determined a recovered population should have at least 250 groups annually fledging young (reproducing population). Present research indicates, on average, meeting this criterion would require 500 active clusters in the population. Therefore, a population objective of at least 500 active clusters must be established for recovery populations, if the land base allows. However, with population specific reproduction data, a population can be declared recovered if it has at least 250 groups annually fledging young for 5 consecutive years, and the population is not artificially maintained through

translocation and artificial cavities. A population being declared recovered in no way affects the population objective. Support populations must be managed for at least 50 active clusters to ensure short-term viability. Most support populations will have population objectives well above this minimum. Table 2-E1 of the EIS lists the tentative population objective for each RCW population based on the tentative HMA size and broad physiographic province density objectives.

The acreage needed to support a single RCW group varies by physiographic province. In general, habitat quality in the lower coastal plain is higher than that in the piedmont and mountains. Within physiographic provinces there is also variability in habitat capability based on ecological factors associated with individual landscapes. Soil properties, hydrology, and topographic features associated with a particular landscape can influence whether the resulting vegetation will be optimal, suitable, or marginal RCW habitat. For example, longleaf pine landscapes in the coastal plain will have a higher habitat capability than loblolly pine hardwood landscapes in the coastal plan. Because of this variability, each affect National Forest will refine the tentative population objectives established in the EIS for each of their HMAs, and establish final population objectives during the Forest plan amendment or revision process. These refinements will be based on the following:

> Acres of suitable and potentially suitable RCW habitat within permanent HMAs.
>
> RCW density objectives for individual landscapes within a given National Forest.
>
> Desired future condition of these habitats based on land type associations.
>
> Generally, RCW population density objectives will fall within the range of one group per 200 to 300 acres. However, it is recognized that some landscapes within a given HMA may require more acres per group. For example, wet loblolly pine-hardwood sites may require 400 acres and pond pine may require as much as 600 to 800 acres per group. No useable RCW habitat within an HMA should be excluded from RCW management, regardless of acres required to support a group.

The following are examples of how the above criteria could work.

Example 1. Support Population Objective

A tentative HMA in the coastal plain includes 50,000 acres of suitable RCW habitat. Based on a broad physiographic province density objective of 1 group per 200 acres, a tentative population objective of 250 groups would be identified. During the Forest Plan revision process a permanent HMA of 53,500 acres could be identified. Assume 80 percent of the HMA is longleaf pine and can support 1 group/200 acres; 15 percent of the HMA is loblolly pine and can support 1 group/250 acres; and 5 percent is loblolly pine hardwood and can support 1 group/275 acres. The HMA population objective would be 256 based on the above breakdown.

Example 2. Recovery Population Objective

A tentative HMA for a recovery population in the coastal plain includes 102,000 acres of suitable RCW habitat, and has a tentative population objective of 510 groups. During the Forest Plan revision process a permanent HMA of 99,000 acres is identified. Assume 90 percent of the HMA is longleaf pine and can support 1 group/200 acres; and 10 percent of the HMA is loblolly pine and can support 1 group/250 acres. The HMA population objective would be 486 based on the above breakdown. If any additional suitable RCW habitat exists on this Forest, the permanent HMA must be increased in size to allow for a population objective of at least 500 groups.

The figures of 1 group/200 acres, 1 group/250 acres, and 1 group/275 acres for longleaf, loblolly, and loblolly pine/hardwood, respectively, were used for example purposes only. These values should not be viewed as established standards. Each individual Forest will need to develop their own RCW density objectives based on local conditions.

(4) Establishing Management Intensity Levels

Alternative E would establish four different MILs, based on the risk of extirpation faced by the RCW in each HMA or subpopulation within an HMA. Two sets of MIL classification criteria were developed; one set for populations with a land base large enough to support 500 groups, and another set for populations with inadequate acreage to support 500 groups.

(5) Establishment of Subhabitat Management Areas

Several RCW populations have very few groups, but would require delineation of relatively large HMAs. Many of these are identified as recovery populations in the RCW Recovery Plan and therefore require HMAs large enough (100,000 to 150,000 acres of suitable habitat) to support 500 or more

active clusters, despite the fact they contain few RCWs at present. Also, some support populations, due to the presence of two or more widely separated subpopulations, may have large HMAs with relatively few RCWs.

It would likely take decades for an RCW population to grow to fill the available habitat within these HMAs. The Forest Service proposes a sub-HMA strategy for the large area/small population HMAs.

Upon approval of the Regional Forester, a sub-HMA(s) may be delineated within an HMA. All active RCW clusters must be included in the sub-HMA(s). Each sub-HMA will be approximately 10,000-15,000 acres of suitable habitat; large enough to support 50 RCW groups and sustain short-term viability. Management within the sub-HMA(s) would be according to standards and guidelines established for MIL 4. The immediate and short-term needs of existing RCW groups would be met within the sub-HMA.

The areas within the HMA, but outside the sub-HMA, would be managed according to standards and guidelines established for populations in MIL 2. Regeneration of forest stands, using two-aged or uneven-aged silviculture, could continue. Acceptable habitat for future RCW population expansion would be maintained over time by either of these silvicultural practices. Although this strategy would allow the continued harvest of some forest products, timber production is secondary to meeting RCW habitat objectives.

The sub-HMA strategy is desirable because it allows the forest manager to move toward establishing a balanced age/size class distribution which should be beneficial to the RCW in the long-term. A balanced age/size class distribution helps ensure a sustained flow of RCW habitat through time and may make the forest less vulnerable to damage by hurricanes (Hooper and McAdie, in press). The sub-HMA strategy also helps reduce economic impacts, especially in the most heavily impacted rural areas. The Forest Service believes that this economic concession can be made with no adverse effects to the RCW.

Management based on MIL 2 standards and guidelines would ensure suitable habitat for RCW population expansion when the population of the sub-HMA begins to expand into the remainder of the HMA. When considering regeneration methods within these areas, restoration of longleaf or other desirable pine species would receive priority due to its long-term positive benefit to RCWs.

(6) Protection of Clusters, Replacement, and Recruitment Stands

The Forest Service proposes to incorporate the following standards and guidelines into the Handbook to ensure RCW clusters, replacement, and recruitment stands are not adversely affected by other forest management activities.

1. Cutting

All alternatives would prohibit timber harvest, cutting, or killing of trees within clusters, recruitment stands, and replacement stands except where those actions would protect or improve RCW habitat. Snags or other dead trees should not be removed unless they posed a threat to public safety.

The alternatives would prohibit cutting of cavity trees in active and inactive clusters unless they posed a threat to public safety, or to protect the cluster, recruitment stand, and replacement stand from insect attack. The Service shall be consulted and issue a concurrence before any cavity tree would be cut.

2. Motorized, heavy equipment, and concentrated human use areas

Alternative E requires habitat improvement projects involving motorized or heavy equipment to include sufficient project administration and/or contract language to protect clusters, recruitment, and replacement stands, especially cavity trees and potential cavity trees.

These alternatives would prohibit concentrated equipment use, such as log decks, pine straw bailing operations, off-road vehicle trails, trail heads, and camp sites within clusters, recruitment, and replacement stands. The Forest Service will relocate or modify existing uses and activities if they are found to adversely affect the RCW. The Forest Service will locate all future concentrated human use areas, such as off-road vehicle trails, camp sites, and trail heads outside of cluster, recruitment, and replacement stand boundaries.

3. Cavity tree protection during prescribed burning operations

All alternatives encourage prescribed burning to control midstory vegetation for the benefit of the RCW, but require burning prescriptions and cycles to minimize risk to cavity trees.

Cavity trees may be protected by raking away or back burning

adjacent fuels. Plow lines will be placed beyond 200 feet of cavity trees to prevent root damage unless needed to protect the cavity trees during an emergency or if site specific circumstances, such as property boundary locations, dictate the need to locate them closer.

4. Nesting season disturbance

The Forest Service would require scheduling all potentially disturbing activities within the cluster before or after the nesting season. The general nesting season dates will be used unless the specific group's nesting season is documented and monitored to account for individual variation.

The Forest Service would also restrict its habitat improvement activities within clusters during the nesting season, unless such activity during the nesting season is necessary for the continued survival of the RCW group. An exception to this limitation is prescribed burning, which may be allowed.

5. Construction of rights-of-way

Alternative E would prohibit all construction of linear rights-of-way, such as roads, powerlines, or pipelines within a cluster, recruitment or replacement stand.

6. Existing rights-of-way reconstruction and maintenance

Alternative E would allow reconstruction or maintenance of existing roads through clusters, recruitment, and replacement stands if detailed study shows such activities will not adversely affect RCWs and the activities are scheduled before or after the nesting season.

Road and rights-of-way reconstruction/maintenance through clusters will be closely monitored to ensure protection of cavity trees and potential cavity trees. Light maintenance of high standard open roads, such as road grading or mowing of the rights-of-way, which are no more disturbing than the passage of normal traffic, will be allowed during the nesting season.

7. Southern pine beetle suppression

The Forest Service will attempt to minimize the impacts of southern pine beetles to cavity trees and foraging habitat. When RCW clusters, recruitment, and/or replacement stands are threatened by southern pine beetles, a biologist and entomologist would recommend a course of action before taking control measures.

Alternative E differs from the Biological Opinion on the Southern Pine Beetle FEIS and Record of Decision and other alternatives in that wilderness RCW groups are considered non-essential and therefore southern pine beetle control would not be initiated to protect wilderness RCW groups or their foraging habitat. However, southern pine beetle control could be initiated within wilderness to protect RCW groups or their foraging habitat if they are immediately adjacent (within 1/4 mile) to the wilderness boundary. Foraging habitat that occurs in wilderness will not be protected.

(7) Management of Clusters, Replacement, and Recruitment Stands

The Forest Service proposes to actively manage RCW clusters, recruitment, and replacement stands to ensure continued population viability and growth.

1. Marking cavity trees and cluster boundaries (monumentation)

All alternatives require the marking of cavity trees to reduce the risk of accidental damage. The Forest Service must know where cavity trees are located on-the-ground to consistently apply the protective standards and guidelines and monitor clusters.

The Forest Service will mark all active and inactive cavity trees and examine/update appropriate information whenever a cluster is visited. The boundaries of clusters and recruitment stands with cavities (active or inactive) must be marked when a project that would alter the habitat, such as tree harvesting or road construction, is planned within 1/4 mile of the site (active and inactive). Marking cluster/recruitment boundaries may be temporary (signs or flagging tape) or permanent (paint).

2. Cluster status - data base management

All alternatives would recognize and require tracking of six cluster status categories (active, inactive, abandoned, historic, destroyed, and invalid). The Forest Service will maintain and update a data base which includes status category of all RCW clusters within the HMAs. The data base will link monitoring and survey data and show areas where replacement and recruitment stands are necessary.

Cavity trees will be preserved in all cluster categories except "invalid". Special cluster management is not required for abandoned, historic, or destroyed clusters unless identified as recruitment or replacement stands. Changes in

cluster status will be tracked and the database updated annually. Active clusters may be declared inactive if RCWs are not occupying and/or defending them.

3. Recruitment stands

Alternative E would establish recruitment stands. The Forest Service will establish recruitment stands in each HMA where the population objective exceeds the current RCW population. Recruitment stands are optional in MIL 1. The number of recruitment stands should equal the HMA population objective minus the number of groups in that HMA. The selection criteria are found in the EIS.

4. Replacement stands

Alternative E would establish replacement stands, which are crucial for sustaining populations, for all active clusters. These stands will replace existing clusters as their cavity trees die. The selection criteria are found in the EIS.

5.Midstory vegetation control

Midstory reduction/control is a critical element of RCW recovery. Alternative E requires midstory control in the entire nesting habitat stand, but on not less than 10 acres. The treatment should eliminate all hardwood midstory trees within a 50-foot radius of all active and inactive cavity trees. An average of three selected midstory hardwoods per acre can remain throughout the remainder of the cluster. Desirable species are dogwood, redbud, or other shrubby fruiting or flowering species.

Pine midstory should be controlled when the trees block access to cavity trees, potential cavity trees and line-of-sight between them. However, the pine midstory (usually saplings and pole size trees) needed to replace the stand must be reserved. No more than 10 within canopy hardwood trees per acre, dominant and co-dominants, may be reserved within the treatment area.

In areas where cluster, recruitment stand or replacement stand boundaries may include natural hardwood areas, such as stream bottoms, no treatment should occur to eliminate hardwoods or to control midstory within the natural hardwood area unless absolutely necessary to maintain the viability of the RCW group.

Outside clusters, recruitment, and replacement stands but within the HMA, the reduction of hardwood midstory is encouraged in the pine and pine-hardwood forest types. The objective is improvement of foraging habitat. Prescribed

burning will be the primary tool to accomplish this objective.

Prescribed burning is generally the best way to control midstory vegetation, especially small hardwoods. RCWs prefer an open park-like forest which can be maintained by underburning every two to five years after pine trees reach a fire-resistant stage.

Emphasis should be placed on growing season burning, especially in those habitats which were naturally maintained by growing season fires: e.g., longleaf pine-wiregrass, longleaf pine-bluestem and shortleaf pine-bluestem. This would approximate natural conditions historically prevalent in these habitats. After midstory is controlled, burning during other seasons can be used infrequently.

The Forest Service will prioritize and schedule maintenance burns for those clusters, recruitment, and replacement st[illegible] having already received initial treatment to eliminate midstory. Maintenance would receive priority to ensure previous investments in initial midstory control are not lost.

6. Artificial cavities

Alternative E would require artificial cavities in MIL 2 through MIL 4, and recommend additional start holes for higher risk populations. The Forest Service will use the procedures and methods specified by Taylor and Hooper (1991) and Allen (1991) to construct or install artificial cavities in suitable trees. Only individuals experienced in the respective techniques will install artificial cavities. Midstory vegetation must be controlled in conjunction with installation of artificial cavities. The Forest Service would prioritize and schedule installations to provide cavities where they are needed most. Priorities for installing artificial cavities are enumerated in the Draft EIS.

7. Cavity restrictors

Cavity restrictors are metal plates with an oblong hole large enough (generally 1-3/4" by 2-3/4") for the RCW. Cavity restrictors are placed around cavity entrances to prevent other birds (especially pileated and red-bellied woodpeckers) and mammals from enlarging them and displacing the RCW (Carter et al. 1989). Limited cavity availability in some areas, has adversely affected the RCW. Cavity restrictors should be placed on enlarged RCW cavities and on unenlarged cavities where experience shows cavity enlargement is likely. The highest priority is active clusters which have a single

cavity tree followed by single bird groups, then those clusters with two to four suitable cavities, and five to eight cavities.

All artificial cavities should be fitted with restrictors when installed. Restrictors should not be used on cavities which have been enlarged internally to the point of being unusable by RCW. The Forest Service will monitor cavity restrictors to ensure proper installation and acceptance by the RCW.

Alternative E requires the use of restrictors, where needed, in MIL 2 through MIL 4, and in MIL 1 if warranted by the particular site-specific conditions.

8. Translocation

The Forest Service will develop priorities and schedule translocation of RCWs to best achieve the desired objectives. Translocation priorities are usually based on the spatial distribution of existing groups and the probability of successful natural dispersal by juvenile RCWs. Any single-bird group could be a candidate for augmentation, one type of translocation in which a juvenile RCW of the appropriate sex is moved to a single bird group to create a potential breeding pair.

However, if a single-bird group is more than a mile from another group containing a breeding pair it would be a higher priority than a single-bird group which had four or more breeding groups within the same mile distance. This is because the RCW in the second example has a much higher probability of receiving a new mate through natural dispersals than does the one which is far removed from a breeding group.

The priorities for reintroduction of RCW groups varies by management objective. If the technique is being used to expand an existing population, the priorities would be similar to those above for augmentation. The Forest Service recommends that this method not be used until all single bird groups in the population have been augmented. If the management objective is the reestablishment of RCWs into currently unoccupied habitat, those areas known to have held RCWs since 1970 should be first priority.

The translocation of RCWs within populations/subpopulations is encouraged. The short distances birds must be moved and the frequent similarity of the habitat may increase the probability of successful pairings. If translocations between populations are necessary, it is desirable to move birds between areas that are of similar latitude, elevation,

and forest type.

The planned translocation of RCWs will be required to maintain the genetic viability of populations with a reproducing population of less than 250. The effectiveness of such translocations will depend on the number of RCWs moved to a specific population and the genetic makeup of these birds in relation to the receiving population. Such genetic exchanges can be through normal subadult augmentation.

The objective is to identify all single bird groups and move an appropriate sex juvenile bird to it, in an effort to create a breeding pair. Priority should be given to single bird groups in RCW populations with fewer than 50 active clusters.

(8) Habitat Management Within HMAs

The area within HMAs and outside of cluster, recruitment, and replacement stand boundaries would be managed for a full range of multiple uses, but would emphasize the sustained production of RCW foraging and future nesting habitat.

1. Prescribed burning

The Forest Service should annually prescribe-burn approximately 490,000 acres within HMAs throughout the Southern Region. The Forest Service would schedule as many prescribed burns as possible during the growing season, where appropriate. However, the acreage to be burned to accomplish habitat goals may require burning whenever conditions permit year-round. The Forest Service will use natural firebreaks (streams, swamps, lakes, etc.) wherever possible to reduce the impact from constructing firelines.

2. Pine restoration

As important as restoring desirable pine species is to the long-term survival and recovery of the RCW, it is also important to schedule pine restoration to minimize any potential adverse effects of creating age class imbalances in the pine type age class distribution. When developing a restoration program, a Forest plan must first identify the total number of acres within an HMA needing to be restored. Based on this information, an individual Forest Plan has the flexibility to determine how many acres to restore per entry to meet its objectives. The Forest Service would base the rate of pine restoration on rotation and age class distribution for either forest type or management type.

- The forest type describes the species of trees currently growing on the site. For example, the existing longleaf pine age class distribution would determine the number of acres restored to longleaf pine each decade.

- The management type describes which species would have historically occupied the site. For example, the age class distribution of existing longleaf pine plus whatever loblolly, slash pine, etc., are growing on longleaf sites would be combined to calculate the number of acres restored to longleaf each decade.

Management types do not reflect the actual acres of the preferred species, in this longleaf pine example. The inclusion of the acres occupied by the off site species inflates the total acres, which in turn increases the acres which could be cut each decade. For example: An HMA contains 10,000 acres of existing longleaf pine. Off site slash pine is growing on another 10,000 acres. If the acres to be regenerated is based on forest type for the desired species, 830 acres could be restored to longleaf each 10 years. If regeneration acres are based on management type (the longleaf acres plus off site acres), 1660 acres could theoretically be harvested each 10 years.

If the allowed regeneration acres based on management type were cut from the existing longleaf stands they would be rapidly harvested. Therefore, if management type is used to determine the rate of pine restoration, Alternative E prohibits regeneration of existing stands of the species being restored until these stands reach rotation age. To continue with the above example, none of the existing longleaf stands could be regenerated until they reach rotation age (120 years). Alternative E makes an exception to this regeneration restriction where the restored pine type (longleaf) is managed as an uneven-aged stand.

In order to expedite the restoration of desirable pine species, the number of acres which can be regenerated the first entry period should be the restoration target for all subsequent entry periods. Again using the above example for management type, 1660 acres of restoration would be the objective each 10 year entry period until all restoration is completed.

When restoration is complete, all restored acres are calculated in the restored pine type age class distribution. Alternative E would restrict the number of restoration acres in the 0 to 10 and 0 to 30 year age classes in the same manner as any other regeneration acres. If during forest

planning it is determined to be desirable to expedite the rate of restoration, a Forest Plan may do so as long as there are no short-term adverse effects on RCW and there will be a long-term benefit to RCW. Therefore, alternative E would make three exceptions to the age class requirements.

(1) HMAs with Sparse or Scattered RCW Populations.

To expedite restoration beyond 1.5 miles from active clusters, foraging habitat for recruitment stands beyond this 1.5 mile buffer may be reduced as described in the EIS. To ensure landscape conditions exist that will not adversely affect the RCW, the following standards must be followed:

During the first 10 to 20 years, accelerated restoration efforts should be focused on the area outside the 1.5 mile buffer around active clusters.

The restoration objectives must ensure corridors linking buffer areas are not fragmented by avoiding the creation of permanent or temporary barriers that inhibit or prevent RCW movement between areas of activity. A barrier is considered to be any non-forest area or any forested area not providing foraging habitat or a combination of the two greater than 330 feet wide. Any openings created cannot completely isolate or sever a cluster, recruitment stand, or replacement stand from its foraging habitat, sever connecting corridors, etc.

Recruitment stands must not be isolated from continuous pine or pine-hardwood overstory canopy.

To expedite restoration, the 0 to 10 year age class restrictions can be exceeded during the first 20 years of implementation, but in no case should the 0 to 10 age class exceed 15 percent. The 0 to 30 year age class restrictions can be exceeded during the first 20 years of implementation, but in no case should the 0 to 30 age class exceed 40 percent. These age class calculations should be based on the management type, which in most cases will be longleaf or shortleaf pine.

Regeneration patch size for restoration will not exceed 40 acres.

All trees of the desirable species will be retained during restoration, unless their density is greater than 70 square feet of basal area, in which case the desired trees should be thinned to improve RCW habitat conditions.

(2) Off site pines occupying the site.

Restoration could exceed the 0 to 10 and 0 to 30 age class distribution guidelines when the soils or other site factors are truly incompatible with the pine species currently growing there. The existing pine trees may be subject to very slow growth, stagnation (growth stops completely), or may grow quite well for a period of time, perhaps as long as 50 years, then suddenly die.

Under certain circumstances an accelerated rate of restoration may be desirable. An example is off site species which die at a rapid rate, reducing available foraging habitat for RCW groups. This is a "Catch 22" situation. To regenerate the stand and restore the proper species will essentially eliminate its foraging suitability. At the same time, natural mortality is rapidly reducing the available foraging. Such cases require a thorough site-specific analysis to evaluate impacts and trade-offs, and to determine what mitigation measures are available.

(3) Off site pines less than 10 inches in diameter.

A third exception to the above limitations on the acres which can be regenerated in any 10-year period is truly off site species which are not large enough to be foraging habitat (less than 10 inches diameter). An example is stagnated slash pine which may be 25-30 years old but only 4-5 inches in diameter. In such situations pine restoration is encouraged and can proceed at an accelerated rate. However, even in these situations some thought should be given to spreading out the regeneration to avoid undesirable age class bulges in the future.

During all restoration efforts all existing trees of the species being restored should be retained. This will expedite development of potential cavity trees. Any pine restoration which exceeds the acres normally allowed in the 0-10 and 0-30 age classes must be approved in writing by the Regional Office of the Forest Service.

3. Foraging habitat management

The Forest Service would evaluate foraging habitat within 1/2 mile of clusters and recruitment stands when pine tree removal is planned to ensure adequate foraging habitat is available after any harvest. Procedures described in the Fish and Wildlife Services' Guidelines for Preparation of Biological Assessments and Evaluations for the Red-cockaded Woodpecker (Bluebook) (Henry 1989) will be followed.

Hooper and Lennartz (in press) suggest there may be some circumstances when a RCW population would benefit in the long-term by having its foraging habitat reduced below Bluebook standards. Some examples of such circumstances are in: (1) recovery HMAs where the risk from hurricanes makes it especially desirable to have a balance of age classes as soon as possible (Hooper and McAdie, in press), (2) thinning pine stands to reduce the risk of southern pine beetle infestation, (3) the removal of trees infested with southern pine beetles in order to avoid a major epidemic (Billings and Varner 1986), and (4) restoration of longleaf or other desirable pine species.

When reducing foraging habitat below established levels for restoration of more desirable pine types, the following standards apply.

> All active clusters and recruitment stands within 1.5 miles of an active cluster, must have a minimum of 6,350 pine stems ≥ 10" DBH and at least 30 years old, and a minimum of 8,490 square feet of pine basal area, contiguous and continuous with the cluster or recruitment stand and within 1/2 mile of the center of the cluster or recruitment stand. If this habitat cannot be provided within 1/2 mile, it must be provided as close to the 1/2 mile zone as possible (Fish and Wildlife Service 1989). These are the Service's "Blue Book" requirements.
>
> For recruitment stands identified beyond 1.5 miles of an active cluster, foraging habitat can be reduced to 50 percent of the Service "Blue Book" requirements. Therefore, a minimum of 3,175 pine stems ≥ 10" DBH and at least 30 years old, and a minimum of 4,250 square feet of pine basal area would be required. This habitat must be contiguous and continuous with the recruitment stand.
>
> If an active cluster is found or a recruitment stand is activated beyond the 1.5 mile buffer, the Service "Blue Book" foraging requirements must be provided for this cluster as well as all recruitment stands within 1.5

miles of the new cluster. In this manner, as a population grows, all active clusters and recruitment stands within 1.5 miles of an active cluster will have adequate foraging habitat. This buffering must remain in effect until all recruitment stands are within 1.5 miles of an active cluster. At that time, all clusters and recruitment stands will have adequate foraging habitat.

The Forest Service's goal is to provide the highest quality foraging habitat as close as possible to RCW clusters, rather than large areas of poor habitat. Thinning within RCW foraging habitat should maintain at least 70 square feet of pine basal area. Where foraging habitat is limited, the Forest Service will make thinning stands less than 10 inches diameter within 1/2 mile of the cluster (closer to the cluster the better) a priority action. This action helps trees grow faster and shortens the time required for stands to become suitable foraging habitat. The Forest Service will use standard silvicultural prescriptions for thinning young stands.

The Forest Service must provide 100 percent of the foraging habitat equivalent for RCW groups on National Forest Land whose 1/2 mile foraging zone extends onto another ownership (private, state, or other Federal) unless a cooperative agreement exists with the non-Forest Service landowner.

The Forest Service will provide its proportional share of foraging for RCW groups on adjacent private, state, or other federal ownership but within 1/2 mile of National Forest land, even if no cooperative agreement with the non-Forest Service landowner exists.

The cooperative RCW agreement is a contract that ensures adherence to the Fish and Wildlife Service foraging habitat procedures. This insurance would allow foraging habitat equivalents to be shared in proportion to their availability between the Forest Service and adjacent landowner or agency.

4. Establishing rotations

For the following discussion, rotation age refers to the oldest age class grown before an even-aged or two-aged regeneration method is used to produce a new age class and/or the maximum size class grown before an uneven-aged regeneration method is used to produce a new size class.

Even-aged and two-aged silviculture regulates sustainable yields over time by area control. The area control method of regulation allows a certain amount of land area to be regenerated in a given period, usually 10 years. The longer

the rotation, the fewer acres which may be regenerated in that period.

Uneven-aged stands will be regulated by diameter distribution. The distribution should approximate the collective total of the diameter distributions of a series of little even-aged, groups of pine trees covering equal areas and separated by equal intervals of age (Smith 1986). The BDQ (basal area, maximum diameter, and constant ratio of trees in successions of diameter classes) method (Farrar 1984; Farrar and Murphy 1989) will be used to create and maintain a balanced uneven-aged structure.

Table 1 shows minimum rotation ages prescribed in Alternative E, and the amount of land which can be sustainably regenerated per decade. Rotation ages for pine-hardwood forest types would be set by the pine species present.

Table 1: Percentage of Area to Harvest by Forest Type and Rotation Length

Forest Type	Rotation*	Percentage of Area to Regenerate in 10-year period
Longleaf pine	120 years	8.3%
Shortleaf pine	120 years	8.3%
Loblolly pine	100 years	10.0%
Slash pine	100 years	10.0%
Loblolly and short-leaf pine (southern pine beetle option)**	80 years	12.5%
Virginia pine	70 years	14.3%

* The Forest Service recognizes there are sites where trees, for various reasons, will not live to the prescribed ages.

** The proposed action includes an optional rotation for loblolly pine where a high probability of southern pine beetle outbreaks or site limitations make tree survival beyond 80 years improbable.

The Forest Service would calculate appropriate regeneration acres within an HMA Based on:

- o The acres of suitable RCW habitat (pine and pine-hardwood forest types with the potential to produce suitable foraging habitat) within the HMA that are identified as suitable for timber management (Land Class Codes 500 and 600).

- o The rotation that is applied to each forest type represented.

- The existing acreage of each forest type which is in the 0-10 and 0-30 age classes.

- Additional mitigation measures which are identified and discussed in the following sections on the various harvest methods.

- The MIL of the RCW population in question.

The Forest Service must consider the effects of catastrophic impacts from insect, disease, fire, or weather, when considering age class distribution calculations for planned regeneration. For example, if a tornado destroyed 1000 acres of pine type suitable for timber management within the HMA, that acreage must be included in the 0 to 10 age class, which reduces the regeneration acres. All temporary openings such as cuttings to control southern pine beetle must also be included in the 0-10 or appropriate age class.

5. Thinning

Alternative E will utilize the following thinning guidelines in mature stands (greater than 10 inches diameter):

- Maintain pine basal area of 70-110 square feet, depending on site and stand condition.

- If total pine basal area exceeds 100 square feet, do not remove more than 30 square feet of basal area in any single thinning operation, to reduce potential damage to residual trees.

- The priority for selecting pine trees to remain in MILs 2 - 4 are:

  (1) relict trees
  (2) other potential cavity trees
  (3) trees greater than 10 inches in diameter that are not potential cavity trees
  (4) trees less than 10 inches in diameter

- Trees to remain in MIL 1 should be well formed, healthy, and vigorously growing.

If foraging habitat is limited, thinnings will normally not occur. However, if the density of trees within a stand is extremely high, over 110-120 basal area, or there is a moderate to high risk of southern pine beetle infestations, it may be desirable to thin pine stands to achieve a minimum 20-25 foot spacing while maintaining at least 70 basal area of pine even if foraging is limited.

On occasion, stands of pines may be so dense RCWs do not readily use them as foraging. In such situations, it may be desirable to thin these stands back to a basal area of 90 square feet to improve their suitability as foraging, even if foraging is limited.

Over portions of the RCWs range the threat of southern pine beetle infestations is often a factor in making management decisions. A severe beetle outbreak may destroy many acres of RCW habitat in a very short period of time. Therefore, thinning to reduce southern pine beetle hazard is desirable even if foraging may be limited. Such thinnings must be supported by an appropriate southern pine beetle hazard analysis indicating a moderate or higher risk of infestation.

In all cases where foraging is limited, the Forest Service must informally consult with the Fish and Wildlife Service prior to thinning. A site-specific analysis will provide the information base for the consultation, and the decision process must comply with the National Environmental Policy Act, National Forest Management Act, and Endangered Species Act.

6. Clearcutting

Alternative E would allow clearcutting within MILs in specific situations. A site specific evaluation must show a definite long-term benefit and no short-term adverse effects on RCW.

The site specific project level evaluation must show:

- Sufficient foraging habitat is available after harvest for each cluster and recruitment stand.

- Foraging habitat is not fragmented by proposed cutting, but is continuous and contiguous with the cluster or recruitment stand.

- Replacement and recruitment stands are not isolated from respective cluster(s) and adjacent clusters are not isolated from each other by the proposed harvest.

- The distribution of age classes should ensure an even flow of habitat is available through time.

These requirements and limitations must be met before clearcutting can occur in any MIL.

There are three specific situations in which clearcutting may be appropriate:

1. Virginia and pitch pine stands.

The silvical characteristics of Virginia pine and pitch pine make clearcutting the only practical method of regenerating the stand. Virginia pine is shallow-rooted, short-lived, and blows down easily if the stand is opened up. Pitch pine forms branches all along the stem when grown in the open making the tree unsuitable for RCWs. Both species are intolerant of shading and grow well only in the open sunlight such as in old fields or after a catastrophic fire.

2. Understocked or damaged stands.

Uneven distribution and low basal area are typical for these stands. Natural regeneration is often difficult to achieve under such conditions, thus planting and/or seeding may be necessary.

The Forest Service may clearcut these stands if they have fewer than 24 pine trees per acre 10 inches in diameter or larger. If the existing trees in the stand are desirable for RCW and suitable for the site, the standard mitigation based on MIL would apply. For example, the Forest Service must reserve an average of six trees per acre in an understocked or damaged longleaf stand in a MIL 2 HMA.

If the existing trees are an off site species and the stand will be regenerated to a more desirable species, the Forest Service must reserve future cavity trees per the direction below for pine restoration sites.

The Forest Service will prioritize these potential cavity trees in all areas to be clearcut, reserving relics first. The reserved trees may be clumped, scattered, or a combination of clumped and scattered.

3. Pine restoration sites.

The Forest Service may also clearcut stands of off site species which are not understocked or damaged to restore longleaf or other desirable pine species. Pine restoration is described in detail in the EIS. All existing trees of the species being restored must be reserved to provide potential cavity trees in the near future.

7. Seed-tree and shelterwood cutting

Alternative E would allow seed-tree and shelterwood methods only in HMAs classified as MIL 1 and MIL 2.

MIL 1: Shelterwood or seed-tree regeneration methods can be used. The seed trees should be vigorous, well formed, and show evidence of past seed production. Once seedlings are established, the seed trees can be removed. The retention of six potential cavity trees per acre in regeneration areas is optional, but encouraged. These trees could be clumped or left in larger clumps of one to two acres.

MIL 2: Shelterwood method can be used. The first removal would leave 25-30 square feet of pine basal area. The seed trees should be vigorous, well formed, and show past evidence of seed production. Once seedlings are established, the shelterwood trees can be removed except for the mandatory retention of six trees per acre in the regeneration area. These trees are to provide future cavity trees.

The priorities for selecting these trees are:

1. Relict trees
2. Other potential cavity trees
3. Other trees greater than 10 inches in diameter that meet the requirements for seed producers.

Distribution of these six trees per acre over the harvest area, i.e., clumped, dispersed over the area, etc., is at the discretion of the manager. These trees are to be retained as long as the RCW population remains in MIL 2.

8. Irregular shelterwood cutting

Alternative E would permit the irregular shelterwood method in HMAs classified as MIL 1, 2, 3 and 4. See Table 2 for requirements for MILs 1 and 2.

MIL 3: There should be 25-30 square feet of pine basal area per acre left in regeneration areas. These trees are to remain as long as the RCW population remains in MIL 3.

This strategy maintains an element of foraging on the areas regenerated, promotes development of future nesting trees, and reduces the potential for habitat fragmentation.

Trees to be retained as shelterwood should be selected in the following order:

1. Relict trees
2. Other potential cavity trees
3. Other trees greater than 10 inches in diameter that meet the requirements for seed producers.

Distribution of the seed producing trees is at the discretion of the manager. When the RCW population increases, meeting the criteria to move into MIL 2, the shelterwood trees may be removed except for six trees per acre required under MIL 2.

MIL 4: The pine leave basal area is to be 40 square feet. MIL 4 represents the smallest RCW populations, those most vulnerable to extirpation. Therefore, the higher basal area of shelterwood trees is deemed necessary to help insure the population's survival. These trees are to remain as long as the RCW population remains in MIL 4.

Trees to be retained as shelterwood in HMAs in MIL 4 should be selected in the following order:

1. Relict trees
2. Other potential cavity trees
3. Other trees >10 inches in diameter that meet the requirements for seed producers.

When the RCW population increases, meeting the criteria to move into MIL 3, the basal area may be reduced to the 25-30 square feet allowed in MIL 3.

Table 2: Irregular Shelterwood Cutting-Required Number of Reserve Trees by MIL

Management Intensity level	Basal Area (Sq.Ft./Acre) of Reserve Trees	Number Reserve Trees per Acre
MIL 1	0*	0 (6 Optional)*
MIL 2	Not Specified*	6*
MIL 3	25-30**	10***
MIL 4	40**	10***

* Loblolly pine at high risk may be managed on 80-year rotation which requires a minimum of 10 reserve trees (25-30 sq.ft. BA) for MIL 1 through MIL 3 populations.

** Except for longleaf pine which would be subsequently cut to MIL 2 specifications (6 trees/acre) when regeneration is established.

*** In MILs 3 and 4 reserve trees are to be based on basal area, however, not less than 10 trees per acre must be reserved even if the basal area requirement is exceeded.

With longleaf pine, Alternative E would require leaving the 25 to 30 or 40 square feet of basal area (as shown in Table 2) until the longleaf seedlings are well established, and then reduce the overstory to 10 square feet of basal area,

but not less than 6 trees per acre. Using this guideline, stands proposed for regeneration with trees which average less than 17 inches diameter at breast height will require leaving more than 6 trees per acre. For example, an average tree size of 14 inches would require 10 trees per acre, 12 inch trees would require 12 trees per acre, etc. The final reserve trees would follow the same priority list as other species. However, the longleaf reserve trees should be clumped to enhance regrowth of the new stand and potential for new clusters. The longleaf reserve trees would be retained until the HMA was reclassified as MIL 1; if used by the RCW as nest trees they would be retained indefinitely and managed as a cluster.

Loblolly and shortleaf pine provide habitat for several RCW populations, including some recovery populations. Over much of these species range, they are susceptible to attack by southern pine beetles.

Their susceptibility appears to vary by location within the range. For example, loblolly appears to be more susceptible in the western end of its range. Shortleaf appears to be more susceptible in the coastal plain and piedmont physiographic provinces.

In addition, these two pine species are also affected by site related factors. Some loblolly sites, primarily on old agricultural fields that are badly eroded and thus deficient in nutrients and water holding capacity, may not sustain loblolly, as a stand, to a 100 year rotation.

Shortleaf pine is affected by littleleaf disease, a pathogen which may prevent this species from reaching the recommended 120 year rotation.

Alternative E would offer an option for high risk loblolly and shortleaf pine due to southern pine beetle and/or site related stress. This option is based on an 80-year rotation.

The required silvicultural practices would not change for HMAs classified as MIL 3 and MIL 4. However, in MIL 1 and MIL 2 HMAs a minimum of 25 to 30 square feet of pine basal area/acre must be retained, but not less than 10 trees per acre, would be required. The overwood would be retained indefinitely, effectively creating a two-aged stand. The reserve trees will be dispersed over the regeneration area, rather than clumped. Any of these residuals remaining after one rotation would be retained through the next rotation.

Stands managed in this manner, although two-aged, over time would develop the appearance of an uneven-aged stand.

This management option may be implemented under the following conditions:

- o If historical records indicate the dominant overstory species at the landscape level was loblolly or shortleaf pine.
- o If historical records indicate a high probability of catastrophic southern pine beetle outbreaks.
- o If soils information indicates a low probability of loblolly pine living, as a stand, to the 100-year rotation age.
- o If historical records indicate the presence of littleleaf disease on shortleaf sites.
- o Requires approval of Regional Office with Fish and Wildlife Service concurrence, at the Forest Plan Level.

9. Group selection cutting

The group selection method of regeneration involves removal of trees, usually the oldest or largest trees, in scattered patches at relatively short intervals (about every 10 years), repeated indefinitely, to encourage the continuous establishment of regeneration and maintenance of a balanced uneven-aged stand (Farrar 1984; Smith 1986). A balanced uneven-aged stand managed by using the group selection system is made up of essentially even-aged groups of pine trees. Each size class, ranging from seedlings to large trees, would occupy approximately the same number of acres in each stand but would be arranged in an number of openings ranging from about 1/4 to 2 acres in size.

The group selection method should work to regenerate uneven-aged stands of loblolly, shortleaf, and longleaf pine on some sites (Baker 1987). Use of the group selection method to regenerate longleaf pine on <u>medium</u> sites has been tested for about 15 years. Farrar and Boyer (1991) state: "A selection system may not work well for longleaf pine on very poor, dry, sandy sites, wet flatwood sites with dense palmetto understories, or very good mesic sites, because prescribed burning for competition control and/or seedbed preparation may be difficult to achieve."

10. Single tree selection cutting

The single-tree selection method involves removal of selected pine trees from all merchantable diameter classes (usually 6" DBH and larger) at relatively short intervals (3- to 15-year intervals, depending on stand basal area growth), repeated

indefinitely, to encourage the establishment of scattered pine regeneration throughout the stand usually under high pine shade and maintenance of a balanced uneven-aged stand structure (Farrar 1984, Smith 1986, Farrar and Murphy 1989). Care must be taken not to reduce genetic quality and diversity by cutting only the best dominant individuals (high grading).

The single-tree selection method is best adapted to tolerant, late-successional species, but has been successfully used to regenerate loblolly and shortleaf pine in uneven-aged stands, provided hardwood competition is controlled on a regular basis (Baker 1987). Boyer (1993) states this method is not appropriate to regenerate longleaf pine because of this species intolerance to competition from any source, especially overtopping trees. It is assumed Boyer's statement is made in the context of maximizing timber production.

Platt et al. (1988) and others suggest that longleaf perpetuates itself primarily through a system much like single-tree selection. Growth of regeneration may be very slow, taking 70-100 years to grow foraging size trees.

Single-tree selection can be used on loblolly and shortleaf sites, but may require herbicide use to achieve desired hardwood control. It is difficult to burn intensively enough to control hardwood midstory without destroying the pine regeneration.

Single-tree selection does not generally produce suitable nesting habitat in loblolly and shortleaf pine, because such all-aged stands develop a heavy, but necessary, pine midstory. It is not recommended for managing areas where production of nesting habitat is an objective.

(9) Monitoring

1. Population monitoring

Population monitoring is necessary to protect and prioritize management actions in RCW clusters and determine reproductive success. The Forest Service would monitor RCW populations at intervals determined by population size and trend.

1. Population Size and Trend

   Determine population size and track population trends on an annual basis using sequential periodic surveys of compartments (Hooper and Muse 1989).

2. Group Check

Check all active and suspected active clusters, count the RCWs in each group, and identify all single bird groups.

This consists of annual roost checks of active clusters to determine presence of birds. Identification of single bird groups is critical. Schedule translocations for single-bird groups. Translocations will require additional monitoring to evaluate success. For short periods this monitoring could be very intensive.

3. Nest Success

Determine nesting success for all groups with two or more birds at the appropriate MIL and tally young.

4. Group Survey

Survey all potential RCW nesting habitat in at least 10 percent of the compartments and tally new clusters and groups.

Systematic searches of all suitable nesting habitat in 10 percent of compartments annually will identify the location of all new clusters and groups. Where possible, pursue cooperative efforts with other responsible agencies to complete surveys of suitable but unsurveyed RCW habitat on lands adjacent to National Forests. Lands within 3/4 mile of the National Forest boundary would be highest priority.

5. Problem Identification

Identify problems affecting any groups potentially caused by flying squirrels, rat snakes, avian competitors, etc.

Identifying competition by other cavity nesters or predators and loss of cavities could help the forests prioritize and schedule work to resolve these problems (e.g., remove squirrels, install snake and squirrel excluders, install nest boxes for competitors, etc.).

2. Habitat monitoring

Habitat monitoring is necessary to assure that RCWs have adequate nesting and foraging areas to support recovery populations in the future.

6. Cluster Status Check

The Forest Service would survey each cluster (active and inactive), and recruitment stand with artificial cavities, at intervals determined by population size and trend. The information would be updated each year and be used to assess management needs and schedule actions that meet those needs. Several pieces of data can be collected on a single visit. Clusters near activities that are potentially disturbing to RCWs, such as timber sales, should be checked during and after the activities are completed.

(10) Southern Pine Beetle Hazard Reduction

Alternative E recommends that thinnings be used to maintain tree vigor and reduce southern pine beetle risk. The Forest Service would thin stands where southern pine beetle hazard was moderate or greater to achieve a minimum 20-25 feet spacing between trees but maintain an overstory pine basal area of at least 70 square feet per acre. Alternative E would follow the standard Southern Region thinning guides (except for RCW tree selection criteria). The Regional thinning guides recommend a range of 60-110 square feet of residual pine basal area, depending on site and stand conditions, and the availability of RCW foraging habitat.

(11) Clearing for Nontimber Management Purposes

The removal or clearing of forest cover for oil/gas exploration, developed recreation sites, creating a lake, etc., may create a permanent loss of RCW habitat. Permanent clearing of potential RCW habitat should not occur unless the loss of such habitat would not reduce the capability of the HMA to support its identified RCW population objective.

The Forest Service would evaluate all proposed clearings within HMAs and determine whether they would impact the RCW.

- Clearing would not be allowed if foraging habitat is limited or if the clearing causes a break between the foraging habitat and the cluster or recruitment stand.

- Permanent clearings within 1/4 mile of groups in MIL 3 and MIL 4 should not occur. In situations where mineral rights belong to a party other than the Federal government, limiting such clearings may be difficult or impossible to enforce.

STATUS OF THE SPECIES

Red-cockaded Woodpecker

Species Description

The U.S. Department of the Interior identified the RCW as a rare and endangered species in 1968 (USDI 1968). In 1970, the RCW was officially listed as endangered (Federal Register 35:16047). With passage of the ESA in 1973, the RCW received the protection afforded listed (endangered) species under the ESA.

The current distribution of this non-migratory, territorial species is restricted to the remaining fragmented parcels of suitable pine forest in 13 southeastern states; it has been extirpated in New Jersey, Maryland and Missouri; see Table 3 for current populations by state (Costa and Walker 1995). Although populations have become more fragmented and isolated, the RCW is still rather widely distributed. RCWs survive as very small (1-5 groups) to large (groups of 200 or more) populations. Small populations in the interior are found in southeastern Oklahoma, southern Arkansas, eastern Tennessee, southeastern Virginia, and southeastern Kentucky. The majority of the largest populations remaining are located in the longleaf pine forests of the Sandhills of North and South Carolina and the Coastal Plain longleaf pine forests of North and South Carolina, Georgia, Florida, and Louisiana; a relatively large population also occurs in the loblolly/shortleaf pine forests of eastern Texas.

Table 3: Number of Active RCW Clusters, by State and Land Ownership Category in 1994 (Costa and Walker 1995).

	Ownership			
State	Federal	State	Private	Total
Alabama	150	8	25	183
Arkansas	35	0	121	156
Florida	1063	128	94	1285
Georgia	431	2	218	651
Kentucky	5	0	0	5
Louisiana	422	10	73	505
Mississippi	152	0	22	174
North Carolina	408	162	163	733
Oklahoma	0	9	1	10
South Carolina	456	39	186	681
Tennessee	1	0	0	1
Texas	218	26	61	305
Virginia	0	0	5	5
Total	3341	384	969	4694

Life History

The RCW is a territorial, non-migratory, cooperative breeding species (Lennartz et al. 1987; Walters et al. 1988). It is unique in that it is the only North American woodpecker that exclusively excavates its roost and nest cavities in living pines. Usually, the trees chosen for cavity excavation are infected with a heartwood decaying fungus (*Phellinus pini*) (Jackson 1977; Connor and Locke 1982). The heartwood associated with this fungus, and typically required for cavity excavation, is not generally present in longleaf pine and loblolly pine until 90-100 and 75-90 years of age, respectively (Clark 1992a; Clark 1992b). Each group member has its own cavity, although there may be multiple cavities in a cavity tree. The aggregate of cavity trees, surrounded by a 200 foot forested buffer, is called a cluster (formerly colony) (Walters 1990). Cavities within a cluster may be complete or under construction (starts) and either active, inactive or abandoned.

RCWs live in social units called groups (formerly clan); this family unit usually consisting of a breeding pair, the current years offspring and one or more helpers (adults, normally male offspring of the breeding pair, from previous years) (Walters 1990). Walters (1990) and Delotelle and Epting (1992) have documented instances of female helpers. A group may contain from 1-9 birds, but never more than one breeding pair. Groups maintain year-round territories near their roost and nest trees. Juvenile females from the current years breeding season normally disperse on their own, prior to the next breeding season, or are driven from the group's territory by the group (see Walters et al. 1988, for additional RCW sociobiological/cooperative breeding information).

RCWs forage almost exclusively on pine trees. Although in some habitat types they will use smaller pine trees as foraging substrate (Delotelle et al. 1987) they prefer pines greater than 10" diameter at breast height (DBH) (U.S. Fish and Wildlife Service 1985; Hooper and Harlow 1986). Determining the number of pines required to provide the arthropod biomass needed to meet their year-round dietary requirements continues to be a challenging research problem. Many complex and interrelated factors undoubtedly contribute to the answer, including condition of understory plant community, annual weather fluctuations, forest type, soils, physiographic province, season-of-year, fire frequency and intensity, etc. Currently, following Bluebook guidelines (Henry 1989), the number of acres required to supply adequate foraging habitat depends on the quantity and quality of tree stems available.

Population Dynamics

Population Size

Reduction in population size may jeopardize the continued existence of any endangered species because the longer a species remains at low population levels, the greater the probability of extinction from chance events, inbreeding depression, or additional environmental disturbance (Gilpin and Soule 1986, Goodman 1987a, 1987b, Pimm 1991, Shaffer 1987, Underwood 1989). Although population size has a clear relationship to a species' extinction probability, it can be less important than population variability. Large populations may not protect a species from extinction in the face of extreme environmental disturbance (Pimm 1991, Underwood 1989, Shaffer 1987).

Long-term viability of a RCW recovery or a support unit, in genetic terms, depends upon the presence of an adequate number of breeding individuals for the natural processes that increase genetic variability (e.g., mutation and recombination) to offset the natural processes that decrease genetic variability (e.g., genetic draft and inbreeding). Any prediction of a population's viability should not only be based upon these genetic factors, but also must consider the population's ability to survive population fluctuations due to demographic and environmental fluctuations (Koenig 1988) or environmental catastrophes. Although population models to calculate the population size needed to withstand such irregular events are not well-developed, it is generally agreed that demographic and environmental fluctuations necessitate an increased number of breeding individuals to ensure the long-term persistence of a population in an area (Koenig 1988). Because of the cooperative breeding nature of the RCW, their populations may require fewer breeding individuals to meet demographic fluctuations than to withstand genetic changes (Walters, pers. comm.).

The recovery goal for the RCW is to establish and protect, by adequate habitat management programs, 15 viable populations in the major physiographic provinces and forest cover types where the species currently exists. The RCW Recovery Plan (U.S. Fish and Wildlife Service 1985) specifies a <u>minimum</u> viable population size of 250 groups. Personal communication with the preparers of the Recovery Plan (M. Lennartz and G. Henry) has confirmed that 250 groups was intended to represent a reproducing population. According to the best information available, based on data collected in the North Carolina Sandhills recovery unit, between 310 and 390 potential breeding groups are required to meet the viability threshold of 250 successfully reproducing groups (Reed et al. 1993). The Service has required, that in the absence of

population-specific nesting data and following the intent of the Recovery Plan, 400 potential breeding pairs be used as the standard to achieve 250 reproducing groups. Additionally, because up to 25% of groups may contain single birds (usually males), most RCW biologists have agreed, and the Service concurs, that viable populations should contain 500 active clusters (Southeast Negotiation Network 1990). Stevens (in press) recommends that until more realistic spatially-explicit models that incorporate the key social and ecological characteristics of the RCW are developed, 250 breeding groups be considered a minimum. Recovery units will be declared "recovered" when they satisfy the above thresholds over a 5-year period, without artificial cavities or translocations.

Population Variability

Fluctuations in species' population over time can affect significantly the probability of its extinction (Pimm 1991). As a population fluctuates, one or more factors can lead to a chance extinction, e.g., irreversibly lowering population size to a point where it can no longer recover. Consequently, actions increasing a species' population variability may affect the continued existence of the species more significantly than a reduction in population size. Population variability is affected by several characteristics of a species' life history, including: unstable age distributions and reproductive rates; widely variable mortalities resulting from unstable food resources or predation; population density; sex ratios; recolonization rates; and genetic viability (Pimm 1991, Underwood 1989).

Reproductive rates, population density, and recolonization rates may influence RCW population variability more than mortality rates, sex ratios, and genetic viability. RCWs exhibit relatively low adult mortality rates; annual survivorship of breeding male and female RCWs is high, ranging from 72 to 84% and 51 to 81%, respectively (Lennartz and Heckel 1987; Walters et al. 1988a; Delotelle and Epting 1992).

Regarding sex ratios, only 2 studies (Francis Marion National Forest and Central Florida populations) report significantly different fledgling sex ratios than 50:50 (Gowarty and Lennartz 1985; Delotelle, pers. comm.). Other populations (Walters 1990; Stevens, pers. comm.; unpubl. USFS data) report sex ratios not significantly different from 50:50. Because most managers and researchers do not report significant differences from the expected 50:50 ratio, it is assumed that they are finding "normal" ratios. Reasons for the differences in sex ratios between the 2 populations initially discussed and most (presumably) other populations

are uncertain, as are the implications for population variability.

RCW genetic research to date does not suggest that genetic viability is a serious concern at this time; however, genetic variability will decrease in small, isolated populations. Stangel et al. (1992) reported no significant relationship between heterozygosity and population size (when 2 very small populations, of the 26 sampled, were removed from the analysis); additionally, although allelic diversity was correlated with population size and had eroded in some small populations, most populations were still characterized by "normal" levels of genetic variability. Haig and Rhymer (1994) examining the genetic variation among 14 RCW populations concluded that RCWs do not appear to have major genetic differences among regional populations.

Reproductive rates for RCWs are variable. Walters et al. (undated/1988b), based on 8 years (1981-1988) of data for the Fort Bragg RCW recovery unit, found a range of 1.11 to 1.85 fledglings per breeding group; additionally, in some years many groups failed to nest, while in other years most groups attempted to nest. Beyer (pers. comm.) and Fitzgerald (pers. comm.), analyzing 5 years (1990-1994) of reproductive data for the Apalachicola RD recovery unit, found a range of 297 (59%) to 392 (78%) groups for the estimated number of successfully breeding groups in the population of 503 active clusters. Walters et al. (undated/1988b) suggest that annual variation in reproductive effort may be associated with food availability, weather and cavity competition.

Although the relationship between RCW population variability and population density is not well understood, some aspects of population density as it relates to group size, and population trend have been examined. Connor and Rudolph (1991) found that in sparse populations, as fragmentation increased, RCW group size and the number of active clusters decreased. Hooper and Lennartz (in press) suggested that populations with less than 4.7 active clusters within 1.25 miles on average had critically low densities that inhibited population expansion. Beyer et al. (in review) also speculate that low RCW densities (4.8 active clusters within 1.25 miles) on the Wakulla RD, Apalachicola NF may be implicated in that sub-population's declining trend (Costa et al., in prep.; unpubl. USFS data).

RCW populations can be increased dramatically because of their ability to "recolonize" unoccupied habitat, made suitable (everything else being equal) by providing the limiting resource of cavity trees, via artificial cavities (Copeyon 1990, Allen 1991). Several recent examples of significant population expansions have been documented

(Gaines et al. in press; Richardson and Stockie in press; Watson et al. in press); artificial cavity provisioning has been the common denominator. Walters et al. (1992a) conclusively demonstrated that unoccupied sites remain so because they lack suitable cavities. Walters et al. (1992b) cooperative breeding ecological model for RCWs strongly suggests that individual RCWs are better off from a fitness perspective (first year survival, rate of successful dispersal, reproductive success at early ages) competing for a high-quality territory (i.e., one with cavity trees) than accepting a territory without this critical resource.

Prior to the routine use of artificial cavities for stabilizing and expanding populations, most populations were declining and many had been extirpated (Baker 1983; Costa and Escano 1989). While acknowledging that most RCW populations have not increased on their own (in the absence of artificial cavities), it is equally important to point out that the two largest populations in the 1980's, the Francis Marion NF recovery unit and the Apalachicola RD recovery unit, increased by approximately 10% between 1980/81 and 1987/88 (FMNF) and 1990/91 (ARD) (Hooper et al. 1991a; Costa et al., in prep.; and unpubl. USFS data). The common denominators in these landscapes were large (480-500 active clusters)/dense populations, availability of well-distributed relic longleaf pines, and open park-like forests, a result of frequent prescribed fire since the 1940/50's.

Population Stability

Population stability, the ability of a species' populations to resist change or dramatic fluctuations over time, directly affects a species' sensitivity to the adverse effects of a proposed action. While many RCW populations have been extirpated, many others, some very small and seemingly demographically isolated, have persisted for a remarkable period of time, i.e., 10+ years; although their long-term survival is certainly not secure. This short-term (10+ years) survival (stability is not an accurate description, as most of these populations have been slowly declining) of small populations is probably related to: long life span (10-year old wild birds are not uncommon); predation/exposure protection afforded by a permanent, secure roost chamber; relatively consistent number of fledglings/successful nest; and, cooperative behavior at territory defense and raising young.

Most larger (50+ active clusters) populations are not increasing and can only be classified as stable. The instability of declining populations is frequently related to poor habitat conditions (midstory development, young forests with few potentially suitable cavity trees, habitat loss and

landscape fragmentation), and the demographic isolation of individual groups and/or the intra-population distribution of groups, i.e., density, brought about over time by the gradual loss and degradation of suitable habitat. Intensive management designed to improve habitat conditions at the critical resource, the cluster/cavity tree complex, has contributed to the stability of both large and small populations. Primary management has been the installation of artificial cavities and hardwood midstory control. Additionally, the benefits afforded large/dense populations regarding potential breeding opportunities, accounts in part, for their stability.

Status and Distribution

Reasons for Listing

The reasons for the RCW's classification as endangered in 1968 were its perceived rarity, documented declines in local populations, and presumed reductions in available nesting habitat. Although professional opinion was widely solicited to make an objective assessment of the RCWs status, much of the information provided was anecdotal. No censuses had been conducted, and no estimates were available of the probable size of regional or local populations nor of availability and trends of nesting habitat.

Rangewide Trend

Until very recently, about 1990 or later, most RCW populations, regardless of location/ownership, were considered at best stable, but more likely declining. Jackson (1978b) estimated the distribution of RCWs by ownership to be 83.6 % Federal, 8.6% State/municipal, and 5.6% private; and suggested that because of their extensive habitat requirements the survival of the RCW on most private lands is problematic. Baker (1983) documented the decline (from 11 nests to 0) and extirpation of a private land population between 1970 and 1981. Ligon et al. (1986) pointed out that nowhere were RCWs known to be increasing in numbers. Costa and Escano (1989) documented RCW population declines in at least 10, and perhaps in as many as 17, populations on National Forests; and they reported the extirpation of 5 Forest Service populations. James (1991) studying the Wakulla RD, Apalachicola NF RCW subpopulation concluded that this population was probably declining. Costa et al. (in prep.) and unpublished Forest Service data confirms James' findings. More recently, James (1994) estimated that between the early 1980's and 1990 the number of active clusters rangewide declined 23%; with more than 300 fewer active sites in designated recovery populations. All land ownership categories have suffered declines. In James

(1994) survey, a total of 1,017 and 672 active clusters were reported on private lands in 1980 and 1990, respectively, indicating a 34% decrease; a total of 185 and 155 active clusters were reported on state lands in 1980 and 1990, respectively, a 16% decrease. Numerous other biologists, in Georgia (Baker, in press), North Carolina (Carter, et al. in press), South Carolina (Cely and Ferral, in press), and Florida (Cox, et al., in press) have documented declining populations on Federal, state and/or private lands during the past decade in their respective states.

Recently however, numerous populations, particularly on Federal lands have shown population increases; Savannah River Station, DOE (Gaines et al., in press), Noxubee National Wildlife Refuge (Richardson and Stockie, in press), St. Marks National Wildlife Refuge (Reinman, in press), Francis Marion NF (Hooper, et al. 1991a, Watson, et al., in press), Apalachicola RD, Apalachicola NF (Costa et al., in prep.; unpubl. USFS data), National Forests in Texas (Connor et al. 1995), Vernon RD, Kisatchie NF (unpubl. USFS data), Croatan NF (Walters pers. comm.), and Marine Corps Base, Camp Lejeune (Walters pers. comm.). The Service expects that most populations on Federal properties will eventually increase as proven management techniques and ecosystem management programs are implemented.

The prospect for state land RCW populations, given different responsibilities under the ESA than Federal property, are not as certain. Small populations on private lands can be expected to continue decreasing; largely due to demographic isolation, and continuing degradation and loss of nesting and foraging habitat. Some larger private land RCW populations are currently being protected and managed to at least sustain their existing size (Wood and Kleinhofs, in press; Engstrom, in press). Additionally, new and innovative conservation strategies are being formulated in an effort to minimize the loss of private land RCWs, while providing economic incentives for private landowners (Costa, in press; Smathers et al., in review).

Plants

Pigeon Wings (Clitoria fragrans)

Status: Threatened, Federal Register, April 27, 1993

Description and Reproduction: Clitoria fragrans is an erect perennial herb, 15-50 cm (6-20 inches) tall, with one or a few stems growing from a thick horizontal root that may be more than 2 m (6 feet) long. The stems are wiry (1-2 mm or 0.04-0.08 inch thick) and somewhat zigzag. The leaves have 3 rather leathery leaflets. Leaflets of the upper leaves are

linear (lower leaves somewhat wider) and are obtuse (blunt) at the tip. The leaflets of Clitoria mariana are wider and are acute (pointed) at the tip.

Clitoria fragrans has two types of flowers: chasmogamous (showy insect pollinated) and cleistogamous (small, lacking petals, self-pollinating). Chasmogamous flowers are usually borne in pairs. The flowers are inverted so that the anthers and stigma touch the backs of visiting insects (the only other legume genus with inverted flowers is Centrosema, with two species in central Florida). The corolla has one large petal, the standard petal, 3.5-4.5 cm (1.5-2 inches) long (Fanz 1977) or 4.5-5 cm long (Isely 1990), colored lilac. The keel is small and white. The common name, pigeon wings, refers to the appearance of the flower. It was suggested by McFarlin on a herbarium specimen and adopted by Fanz (1979). Flowers with petals appear from May to June, with a few petalless (cleistogamous) flowers borne as late as September. Small thought the flowers were fragrant. Fanz (1977) detected only a very faint fragrance, but noted a heavy scent of flowering saw palmettos at the locality where Small collected the plant. The seed pod is borne on a stipe (stalk) that projects from the dried calyx (Fanz 1977).

Range and Population Level: Clitoria fragrans is distributed mainly on the Lake Wales Ridge in Highlands and Polk Counties (Fanz 1977; Christman 1988). On the Ridge, it is protected at Arbuckle State Forest and Park, Archbold Biological Station (private), Lake Apthorpe and Tiber Creek (The Nature Conservancy), and at Saddle Blanket Lakes (State acquisition project). It is also present at several sites that may be acquired by the State and/or Fish and Wildlife Service, including Carter Creek (Sebring Highlands) and a tract south of Lake Placid. It is reported to occur at the Avon Park Air Force Range (on the Bombing Range Ridge, a separate landform from the Lake Wales Ridge) (Florida Natural Areas Inventory). It can be considered protected there. Fanz (1977) notes a collection made in Leesburg, Lake County in 1910, and a 1964 collection from Osceola County, 12 miles south of Holopaw via US 441. This site is on one of a series of low ridges with scrub vegetation in ranching country.

Habitat: Clitoria fragrans occurs in scrub vegetation, turkey oak barrens, and at least at the edges of high pine (Christman and Judd 1990); it appears to have habitat preferences similar to Eriogonum longifolium var. gnaphalifolium and Polygala lewtonii, although its range does not extend as far north as these species. Fanz (1979) considers it a species of white sand soils, while the other two species tend to occur on yellow sand. Christman (pers. comm., 1992) considers it a species of yellow sand.

Reasons for Current Status: Loss of habitat, mainly to agriculture (citrus groves and pastures) and residential development, is the primary threat to this species.

Management and Protection: Species is currently protected on various State and Federal properties (see above). State conservation land acquisition in Highlands and Polk counties will probably be adequate to maintain the species if appropriate management can be developed. Management of scrub and of high pineland is reasonably well understood, and The Nature Conservancy is experimenting with restoration of degraded high pineland in the Florida panhandle. Little thought has been given to management of intermediate habitats.

Summary:

Pigeon wings, a member of the pea family, is found in Highlands, Polk, Lake, and Osceola Counties, Florida. This species inhabits sand pine scrub vegetation, turkey oak barrens, and longleaf pine sandhills. Although this species is not currently known to exist on National Forest lands, suitable habitat does exist. Primary causes of population declines include habitat loss due to agricultural and residential development, habitat fragmentation, and fire suppression (Federal Register Vol. 58(79): 25746-25755).

Apalachicola Rosemary (Conradina glabra)

Status: Endangered, Federal Register, July 12, 1993

Description and Reproduction: Apalachicola rosemary was named as a distinct species by Shinners (1962), a treatment that was upheld by Gray (1965) and Kral and McCartney (1991). The branches of Apalachicola rosemary are spreading or upright. The leaves are evergreen, opposite, with additional leaves in short shoots in the axils giving the appearance of fascicles. The leaves are needle-like, "very similar to the needles of fir" (Kral 1983, p. 949). The leaves are hairless on the upper surface—the only species of Conradina for which this is the case. Apalachicola rosemary flowers from March to June and then intermittently until frost (Kral 1983). The flowers are usually in groups of two or three. The calyx and corolla are two-lipped. The corolla is 1.5 to 2.0 centimeters (0.5 to 0.75 inches) long from its base to the tip of its longest lobe with a slender corolla tube that is straight for about five millimeters then bends sharply downward to form a funnel-shaped throat five millimeters long, then widens out into upper and lower lips. The outside of the tube and throat are white with the lobes and lips lavender blue at the tips. The lower lip of the corolla is three-lobed with a band of purple dots extending along its inner side. The four

stamens are paired. Many flowers are male sterile. In extreme cases, the stamens are "grossly malformed, being petaloid in shape, texture, and color. A less bizarre manifestation of male sterility is that in which only aborted pollen grains are contained in anthers that appear completely normal" (Gray 1965). Male sterility may be the result of inbreeding and homozygosity (Gray 1965).

Range and Population Level: Apalachicola rosemary occurs in an area of several square miles in Liberty County, Florida. Part of the species range is incorporated in public and private nature preserves that protect rich hardwood forests with the narrowly endemic Florida torreya (Torreya taxifolia, also federally listed as endangered) and Florida yew (Taxus floridana). Most Apalachicola rosemary, however, occurs on commercial timberland. Currently, the plant is known from seven sites. The population estimate is greater than 10,000 individual plants.

Habitat: Populations are located in a gently undulating upland originally with longleaf pine-wiregrass vegetation, dissected by ravines of the Sweetwater Creek system, which drain westward to the Apalachicola River. Much of the area has been converted to sand pine plantations. Apalachicola rosemary currently is found on road edges, in planted pine plantations and along their cleared edges, and along the edges of the ravines.

Reasons for Current Status: Apalachicola rosemary is a narrowly distributed species that was originally restricted to a specialized habitat, the edges of steephead ravines, and possibly also to upland longleaf pine-wiregrass vegetation. The plant appears to require full sunlight or light shade. Planted pine trees are likely, by the time they mature, to produce dense shade that could kill this species. Another possible problem in planted pine stands is that sand pine (which is currently grown in the area) does not tolerate prescribed fire, which may help keep habitat open for Apalachicola rosemary.

Management and Protection: The Nature Conservancy (TNC) had already established Apalachicola rosemary at three new sites on Apalachicola Bluffs and Ravines Preserve. The new populations were established using cuttings of plants within three kilometers of the Preserve. TNC is conducting studies on the effects of shading and burning to the growth of Apalachicola rosemary. Preliminary results indicate that Apalachicola rosemary growth and reproduction were enhanced in disturbed conditions, i.e. when released from competition, and that the natural fire frequency that resulted in relatively open pine savannas in sandhill communities, may have allowed persistence of this species.

Conservation measures on road and utility rights-of-way may offer opportunities for conserving Apalachicola rosemary. The Florida Department of Transportation is interested in maintaining existing populations along roadsides.

Summary: Apalachicola rosemary is known to exist only in Liberty County, Florida and is threatened by habitat modification. The species is associated with longleaf pine-wiregrass communities and prefers open conditions (Federal Register 1993 Vol. 58(131): 37432-37434). The species is not shade tolerant and its association with longleaf pine-wiregrass communities strongly suggest a need for frequent fires to perpetuate this species.

Scrub Buckwheat (Eriogonum longifolium var. gnaphalifolium)

Status: Threatened, Federal Register, April 27, 1993

Description and Reproduction: Scrub buckwheat is a perennial herb with a single stem that grows from a stout, woody root. Most of the leaves are narrowly oblanceolate, entire, 15-20 cm long, are located at the base of the stem, and are green or bronze-green above and densely white-wooly beneath. Leaves on the stem are smaller and arranged alternately. The stem is erect, up to one meter tall, and terminates in an open panicle. Each branch of the panicle ends in a cup-shaped involucre with five to eight teeth about five millimeters long. Inside each involucre, 15-20 flowers form a cluster. The stalk of each flower starts out erect and then relaxes so that the flowers hang down below the involucre. Each flower is six to eight millimeters long and has six linear sepals. The involucre and flowers are silvery, silky-pubescent (Ward 1979, Wunderlin 1982).

Range and Population Level: The northern range limit for scrub buckwheat is in Ocala National Forest and areas of mixed scrub and high pine south of Ocala in Marion County. It historically occurred near Eustis in Lake County and it still occurs near Clermont in remnants of high pine with Polygala lewtonii. It also occurs at other scattered localities, including Southwest Orange County, the northwest corner of Osceola County, and on the Lake Wales Ridge in Polk and Highlands Counties as far south as the Archbold Biological Station south of Lake Placid.

Habitat: It occurs in habitats intermediate between scrub and sandhills (high pine) and in turkey oak barrens from Marion County to Highlands County (Christman 1988). Other plants that occur in the same areas include Polygala lewtonii, Chionanthus pygmaeus, and Prunus geniculata.

Reasons for Current Status: Loss of habitat to agricultural and residential development. This plant's habitat is also vulnerable to degradation due to inadequate or wrongly-timed fire.

Management and Protection: Scrub buckwheat is protected in the Ocala National Forest, Lake Arbuckle State Forest and State Park, and Nature Conservancy preserves at Tiger Creek and Lake Apthorpe. It is likely to be protected at Catfish Creek and several other tracts if State or Federal land acquisition occurs as planned. Conservation of Eriogonum longifolium var. gnaphalifolium will almost certainly require careful planning and management. Sites that are purchased by the State may require extensive restoration, involving partial removal of oaks and planting/encouragement of reproduction of longleaf pine. Demographic monitoring of scrub buckwheat at some sites will be desirable or necessary. Some may require ensuring that use of herbicides in forestry or road right-of-way maintenance does not jeopardize this plant.

Summary: Scrub buckwheat is a perennial herb that occurs in the Ocala National Forest. This species occurs in habitats intermediate between scrub and sandhills, and in turkey oak barrens. Primary causes for population declines include agricultural and residential development, habitat fragmentation, and fire suppression (Federal Register Vol. 58(79): 25746-25755).

Harper's Beauty (Harperocallis flava McDaniel)

Status: Endangered, Federal Register, October 2, 1979

Description and Reproduction: Harper's beauty is a rhizomatous, perennial herb. Its leaves are stiff and grassy, 5 to 21 centimeters tall. Each plant bears a single flower on a stalk much longer than the leaves. Each flower has six petals, yellow above and greenish beneath. The petals are 9 to 15 millimeters long, spreading when the plant is in flower, erect when in fruit. The petals become entirely green when the plant is in fruit. There are six stamens; the ovary is superior, three-lobed, and ellipsoid; and there are three styles (McDaniel 1968).

The plant is easily identified when in flower. The flower is typical of the lily family (6 petals, 6 stamens, superior ovary), and its solitary, yellow flowers readily distinguish it from all other members of the family in the area. However, the leaves of Harperocallis are almost identical to those of Narthecium and some species of Tofieldia, and in the vegetative condition identification would be difficult, even if the plants could be distinguished from surrounding

grasses. Flowering occurs from mid-April through May and fruits are mature in July. Dispersal mechanisms and pollinators have not been studied. Vegetative reproduction is by rhizomes.

Range and Population Level: The range has remained essentially the same as when the plant was first discovered in 1965. It has been found at three locations, all within the Apalachicola National Forest, approximately 19 miles apart along SR-65 in Franklin and Liberty Counties, Florida. These locations are within about 0.3 miles of each other in Franklin County, while a third reported site is about 19 miles north in Liberty County. Attempts to relocate the alleged Liberty County location have been unsuccessful. Estimated plant population is several thousand plants.

Habitat: Harper's beauty has been found in open pineland bogs and along moist roadside ditches. It seems to be most closely associated with buckwheat tree (Cliftonia monophylla) and odorless bayberry (Myrica inodora), or less frequently, when in wetter situations, with trumpet pitcherplant (Sarracenia flava), parrot pitcherplant (S. psittacina) and pleea (Pleea tenuifolia). Pond pine (Pinus serotina) is the most prevalent tree species associated with these bog habitats. Without occasional fires to eliminate competing herbs and shrubs, natural succession could possibly eliminate the plant from its present locations.

Reasons for Current Status: The plant's limited range makes it highly vulnerable to loss. Changes in current land management, accidental loss, vandalism, and/or overcollecting could easily lead to the extinction of this species.

The U.S. Forest Service currently manages the two Franklin County locations as a reserved area for perpetuation of the species. Management includes carrying out periodic controlled burns to help maintain the open habitat which Harper's beauty requires. Any other uses of the area, especially drainage to allow timber production or mechanical site preparation, would threaten the continued existence of the species. Protection is provided through Forest Service regulations which prohibit removing, destroying, or damaging any plant that is classified as a threatened, endangered, rare, or unique species (FR Vol. 42:2956-2962). The Forest Service and the Florida Department of Transportation are cooperating to maintain an appropriate mowing schedule for the roadside populations. Harper's beauty plants in native vegetation are being monitored, and other sites are being searched. Experimental transplants of plugs of sod containing Harper's beauty appear successful.

Summary: Harper's Beauty is known from 3 locations, 1 in Franklin County and 2 in Liberty County, Florida. All sites are within the Apalachicola National Forest. This species occurs in open bogs and is most prolific in full sun. All known locations are along roads. Major threats to this species include collection and bog succession. Prescribed burning should maintain the open conditions this species needs (USDI 1983).

Pondberry (Lindera melissifolia)

Status: Endangered, Federal Register, July 31, 1986

Description and Reproduction: This deciduous shrub grows to approximately 2 meters (6 feet) tall, and spreads vegetatively by stolons. Pale yellow flowers appear in the spring before the leaves. The bright red, 12-millimeter (one-half-inch) long, oval-shaped fruits mature in the fall. Pondberry is distinguished from the two other North American members of the genus (Lindera benzoin and Lindera subcoriacea) by its drooping, thin, membranaceous, and ovately to elliptically shaped leaves that have a strong, sassafras-like odor when crushed.

Reproduction seems to be primarily vegetative by means of stolons. The plants grow in clones of numerous stems which flower when little more than 2 to 3 years of age, but appear to live for only a few years. The dead stems are replaced by new ones that emerge from the rootstock. The plants bloom around March and are dioecious (male and female flowers are produced on separate plants). Mature fruits can be found on the plants in October, but they seem to have no reproductive value as no seedings have been observed at any of the known sites.

Range and Population Level: The species is presently known from Arkansas in Clay County (four populations); Woodruff County (one population); Lawrence County (one population); and Jackson County (three populations). Georgia has populations in Wheeler County (three populations) and Baker County (one population). Mississippi has one population each in Sharkey County; Bolivar County; and Sunflower County. One population each exists in Ripley County, Missouri and in Bladen County, North Carolina. Berkley County, South Carolina, has four populations. The populations in Arkansas; North Carolina; Sunflower and Bolivar Counties, Mississippi; and the four naturally occurring Georgia populations are on private lands. One of the Georgia populations was originally found only on private land, but because of impacts from domestic hogs, a portion of the population relocated in 1984 to adjacent State protected lands. The populations in Sharkey County, Mississippi, and Berkeley County, South

Carolina, are located on U.S. Forest Service lands. Most of the Missouri population is on land owned by the Missouri Department of Conservation and The Nature Conservancy. Pondberry's historical distribution included Wilcox County, Alabama, and an unidentified site in Louisiana, and Florida, although at least one authority believes the Florida collections were made elsewhere and improperly labeled as to locality. There are 22 currently known locations for pondberry, but the total number of plants has not been determined.

Habitat: Pondberry, for the most part, is associated with wetland habitats such as bottomland and hardwoods in the interior areas, and the margins of sinks, ponds and other depressions in the more coastal sites. The plants generally grow in shaded areas but may also be found in full sun.

Reasons for Current Status: The most significant threats are drainage ditching and subsequent conversion of its habitat to other uses. Even ditching without later conversion of land use can alter the water regime in a manner that reduces the plant's vigor or eliminates it from the site. Domestic hogs, cattle grazing, and timber harvesting have also impacted the plants at some sites. Eight of the sites currently in private ownership have been affected by these various factors, and the remaining sites are potentially threatened. Pondberry receives some legal protection under State law in North Carolina and Missouri, but none in the States of South Carolina, Georgia, Mississippi, and Arkansas. The apparent lack of seedling production is also a factor which in the long term could have significant adverse effects for the species.

Management and Protection: The Delta National Forest, which contains Mississippi's largest population is in the process of developing a program for population monitoring and management. Extensive surveys are being conducted. The Arkansas Natural Heritage program has contacted land-owners to encourage site protection. In Georgia, a fence has been constructed around a site threatened by domestic hogs.

Summary: Pondberry is currently known from Arkansas (10 populations), Georgia (4 populations), Mississippi (13 populations), Missouri (1 population), North Carolina (3 populations), and South Carolina (5 populations). The species may have been extirpated from Florida, Louisiana, and Alabama. The species occurs in seasonally flooded wetlands, sandy sinks, pond margins, limestone sinks, and wet depressions in longleaf pine flatwoods. Major reasons for decline include habitat alteration or destruction through land clearing, drainage modification, or timber harvesting. Pondberry appears to do best under a closed canopy and tree

removal may be detrimental to the species. Activities that could affect hydrology, including fire control plowlines, may have adverse effects on pondberry. There is also an apparent lack of seedling establishment in the wild. Some experimental propagation work has been successful in the Francis Marion National Forest Seed Orchard (Ollie Buckle pers. comm., 1993).

Rough-Leaved Loosestrife (Lysimachia asperulaefolia)

Status: Endangered, Federal Register, June 12, 1987

Description: The slender stems of this perennial herb grow from a rhizome and reach heights of 3 to 6 decimeters (1 to 2 feet). Whorls of 3 to 4 leaves encircle the stem at intervals beneath the showy yellow flowers. Flowering occurs from mid-May through June, with fruits present from July through October (Kral 1983; Radford et al. 1978). This species is easily distinguished from the one other similar southeastern species of Lysimachia, Lysimachia loomisii Torrey, by its broader, glandular leaves and much larger flowers (Kral 1983).

Range and Population Level: Rough-leaved loosestrife is a species endemic to the coastal plain and sandhills of North Carolina and South Carolina. It is currently known from 35 populations in North Carolina and one in South Carolina. The single extant site in South Carolina is in Richland County. North Carolina's extant populations are in the following counties: Brunswick (8 populations); Pender (1 population); Bladen (1 population); Carteret (8 populations); Scotland (3 populations); Cumberland (5 populations); Onslow (3 populations); Hoke (5 populations); and Pamlico (1 population). Historically, Rough-leaved loosestrife was known from 15 other sites in Brunswick, Pender, Cumberland, Onslow, Beaufort, Columbus, Pamlico, and Richmond Counties, North Carolina, and Darlington County, South Carolina. Most of the populations are small, both in area covered and in number of stems.

Habitat: This species generally occurs in the ecotones or edges between longleaf pine uplands and pond pine pocosins (areas of dense shrub and vine growth usually on a wet, peaty, poorly drained soil) (Barry 1980), on moist to seasonally saturated sands and on shallow organic soils overlaying sand. Rough-leaved loosestrife has also been found on deep peat in the low shrub community of large Carolina bays (shallow, elliptical, poorly drained depressions of unknown origin) (Mathews et al. 1980). The grass-shrub ecotone, where rough-leaved loosestrife is found, is fire-maintained, as are the adjacent plant communities (longleaf pine - scrub oak, savanna, flatwoods, and pocosin).

Suppression of naturally-occurring fire in these ecotones results in shrubs increasing in density and height and expanding to eliminate the open edges required by this plant.

Reasons for Current Status: Fire suppression, drainage, and, to a lesser extent, residential and industrial development have altered and eliminated habitat for this species and continue to be the most significant threats to the species' continued existence (Carter 1985; Kral 1983).

Management and Protection Efforts: Many of the remaining populations are on public lands owned by the Department of Defense (Fort Bragg, Camp Lejeune, Fort Jackson, and Sunny Point Military Ocean Terminal), the North Carolina Wildlife Resources Commission, the U.S. Forest Service, and the North Carolina Department of Environment, Health, and Natural Resources. Most of these populations are being managed with controlled burning and are protected from adverse habitat alterations by the land managers. The Nature Conservancy owns and manages one of the North Carolina sites. Another of North Carolina's privately-owned sites is registered as a natural area with the Natural Heritage Program. The North Carolina Natural Heritage Program has also negotiated management agreements with power companies that maintain powerline rights-of-way adjacent to populations. The remaining sites on private land are suffering from fire suppression. Collection and storage of seeds and plant material is planned in cooperation with the Center for Plant Conservation and its member gardens.

Summary: Rough-leaved loosestrife is currently known from nine locations in North Carolina and is believed extirpated in South Carolina. The perennial herb generally occurs in transition zones between longleaf pine uplands and pond pine pocosins, but has also been found in Carolina bays. Primary reasons for endangerment include fire suppression, drainage associated with silviculture and agriculture, and residential and industrial development (Federal Register Vol. 52(113): 22585-22589).

Florida Skullcap (Scutellaria Floridana)
White Birds-in-a-nest (Macbridea Alba)

Status: Threatened, Federal Register, May 8, 1992)

Description and Reproduction: White birds-in-a-nest is an upright, usually single-stemmed, odorless perennial herb with fleshy rhizomes. It is about 30 to 40 centimeters (1 foot) tall with opposite leaves up to 10 centimeters (4 inches) long, 1 to 2 centimeters (0.5 to 1 inches) broad, with winged petioles. With one exception, all the plants at a site are either smooth or hairy (L. Anderson, Florida State

University, pers. comm. 1990; Anderson in FNAI 1989.) The flowers are clustered at the top of the plant in a short spike with bracts. Each flower has a green calyx about 1 centimeter (0.5 inch) long and a brilliant white corolla 3 centimeters (1 inch) long. The corolla is two-lipped, the upper lip hoodlike. Flowering is from May into July (Kral 1983, Godfrey and Wooten 1981). In flower, White birds-in-a-nest is conspicuous and unmistakable. The other species in the genus, Macbridea caroliniana, has rose-purple flowers (Kral 1983) and is a candidate for Federal listing (55 Federal Register 6184).

Florida skullcap is a perennial herb with swollen storage roots. Its stems are quadrangular and sparingly branched, solitary or in small groups. The leaves are opposite, 2 to 4 centimeters (1 to 1.5 inches) long, linear, with the margins strongly inrolled and a blunt, purplish tip. The flowers are solitary in the axils of short leafy bracts. Flower stalks are 5 millimeters (0.2 inches) or less long. The flower has a bell-shaped calyx with a cap or scutellum on its upper side. The corolla is bright lavender blue, at least 2.5 centimeters (1 inch) long, with a throat and an upper and lower lip. The lower lip is white in the middle. Flowering is in May and June (Kral 1983). The Florida panhandle has eight other species of Scutellaria (Clewell 1985).

Range and Population Level: The range of White birds-in-a-nest is in Bay, Gulf, Franklin, and Liberty Counties, Florida. The Apalachicola National Forest has the most vigorous populations, with the largest numbers of individuals of this species. The Florida Natural Areas Inventory surveys show the Forest as having 41 of the 63 known occurrences of this plant. The number of occurrences reported for the National Forest is inflated by the FNAI's treating patches of this plant in separate compartments or stands as distinct occurrences (D. Hardin in litt. 1991). Revisits to plant sites in the National Forest in 1990 yielded different stem counts than in 1987, much lower at some sites, higher at others (J. Walker in litt. 1991)

Florida skullcap is known from 11 sites in Gulf, Franklin, and Liberty Counties, Florida, including five sites in Apalachicola National Forest (FNAI 1989; D. White, in litt. 1990). The plant is not nearly as widespread in Apalachicola National Forest as Florida skullcap (J. Walker, USDA Forest Service, Tallahassee, pers. comm. 1990).

Habitat: These two plant species are restricted to the Gulf coastal lowlands near the mouth of the Apalachicola River, roughly from the southwestern part of Apalachicola National Forest west to the vicinity of Panama City. The two plant species inhabit grassy vegetation on poorly drained,

infertile sandy soils. The wettest sites occupied by these plants are grassy seepage bogs on gentle slopes at the edges of forested or shrubby wetlands. Less permanently wet sites are savannahs (also spelled savanna; also called grass-sedge bogs or wet prairies) (Frost et al. 1986), which are nearly treeless and shrubless but have rich floras of grasses, sedges, and herbs. All two species occur in seepage bogs and savannahs. Florida skullcap is most commonly found in seepage bog communities or savannas near the edges of included wetlands such as bay stringers. Its habitat requirements are more restricted than those for White birds-in-a-nest." (J. Walker in litt. 1991). White birds-in-a-nest occurs sparingly on drier sites with longleaf pine and runner oaks (mesic flatwoods) (J. Walker, USDA Forest Service, pers. comm. 1990). Florida skullcap also occurs in scrubby oak vegetation near the shoreline of the Gulf of Mexico (FNAI 1989).

The frequency and season of fire are very important to the savannah plants, but fire effects can be subtle and research is needed if fire management is to be applied scientifically to conserving the native flora (Robbins and Myers, in prep.; Clewell 1986). Fire during the growing season can stimulate and/or synchronize flowering in many species (Platt et al. 1988), including White birds-in-a-nest (J. Walker, pers. comm. 1990), although it is not yet clear whether this plant thrives better with growing or dormant season fires. "Observations suggest that Florida skullcap is very dependent on fire; individuals etiolate and do not flower in sites unburned for even 3 years. Florida skullcap responds positively and dramatically to growing season fire" (J. Walker in litt. 1991).

Reasons for Current Status: Because these two species occur adjacent to the town of Port St. Joe, expansion of the town would affect them as well as the endangered Chapman rhododendron, Rhododendron chapmanii. Development of improved cattle pastures probably destroyed habitat of these species (Kral 1983), but the extent of loss is not documented.

Silvicultural practices of the forest products industry and the Forest Service affect these two species. Site preparation that precedes tree planting may destroy these plants (Kral 1983; FNAI 1989), although populations may recover in the sunny understory of young pine stands. As plantations mature and become shady, these plants appear to die out.

In Florida, prescribed fire has generally been applied in the dormant season, but pineland herbs may thrive better under a regime of growing season burns (Robbins and Myers, in prep.;

Platt et al. 1988). It is not yet clear whether White birds-in-a nest prefers dormant or growing season fires (J. Walker, in litt. 1991). Florida skullcap reacts positively to growing season fire and appears to require fire to remain vigorous. Additionally, Florida skullcap usually grows at wetlands interfaces at "stand edges where the impact of fire line plowing is disproportionately high. Fire line construction can destroy habitat directly, or indirectly by excluding future prescribed fires. Because . . . the potential for woody plant encroachment is high, growing season fire to control hardwoods is especially important." (J. Walker, USDA Forest Service, in litt. 1991).

Power line rights-of-way provide habitat for these two species, especially telephus spurge in Franklin County (FNAI 1989). On such rights-of-way, use of herbicides to control the vegetation, rather than bush-hogging or mowing, could adversely affect telephus spurge and the other species.

The recorded occurrences of White birds-in-a-nest (FNAI 1989; D. White, in litt. 1990) provide evidence that this species has declined in most of its range. Although the plant occurs in 4 counties, most of its localities are in the Post Office Bay area of Apalachicola National Forest, within 15 miles of each other (J. Walker in litt. 1991), and 10 of the 13 sites with at least 100 stems plants were in the National Forest, including the largest site with an estimated 1,500 plants. The present distribution of existing White birds-in-a-nest plants indicates that this species has declined severely outside the National Forest, because it is unlikely that the National Forest originally had the most, or the largest populations of White birds-in-a-nest. The National Forest is at the edge of this plant's range and areas southwest of the National Forest have richer floras of endemic plants. The present distribution and abundance of White birds-in-a-nest is consistent with Godfrey's (1979) assertion that "modern forestry practices are destroying this species," and Kral's (1983) opinion that drainage, lack of fire, and mechanical site preparation for tree planting reduces or eliminates this and other species including Verbesina chapmanii, Justicia crassifolia, Florida skullcap, and Cuphea aspera. Florida skullcap is a rarer plant than White birds-in-a-nest, so forestry activities would seem to affect it more seriously.

The Forest Service conducts some prescribed burns during the growing season to reduce the incidence of brown-spot infection of longleaf pine seedlings (Robbins and Myers in preparation). This practice may favor White birds-in-a-nest and other herbs. Most private land is planted with slash pine, which is not burned in the seedling stage. Forest Service management practices are intended to benefit White birds-in-a-nest, Florida skullcap, and other sensitive

species including the endangered Harperocallis flava, but management to date has been based on casual observation rather than scientific monitoring to observe whether practices actually benefit the plants (J. Walker and D. White, pers. comm. 1990).

Management and Protection: The U.S. Forest Service's botanists have been monitoring White birds-in-a-nest and Florida skullcap, and concrete, field-tested management guidelines for the Forest can be expected in a few years. Protection of telephus spurge (and the other species off-Forest) may require land acquisition by the State or possibly the Fish and Wildlife Service (perhaps a small mainland annex to St. Vincent National Wildlife Refuge).

Summary:

Florida Skullcap: Florida skullcap is a perennial herb known to occur in Gulf, Franklin, and Liberty Counties, Florida, including 6 sites in the Apalachicola National Forest. This species inhabits grassy seepage bogs, savannahs, and transitions zones between longleaf pine flatwoods and wetter habitats. Major threats to this species include intensive site preparation and planting of savannahs, drainage modification, and fire suppression (Federal Register Vol. 55(243): 51936-51940).

White Birds-in-a-Nest: White birds-in-a-nest occurs in Bay, Gulf, Franklin, and Liberty Counties, Florida. The Apalachicola National Forest has 41 of the 63 known sites for this species. White birds-in-a-nest occur in grassy seepage bogs, savannahs, and longleaf pine flatwoods. Major threats to this species include intensive site preparation and planting of savannahs, drainage modification and fire suppression (Federal Register Vol. 55(243): 51936-51940).

Britton's Beargrass (Nolina brittoniana)

Status: Endangered, Federal Register, April 27, 1993

Description and Reproduction: This perennial grows from a short, thick, fleshy, bulblike rootstock. The leaves are 1 to 2 meters (1 to 2 yards) long and 6 to 13 millimeters wide, forming a rosette. The youngest leaves are upright while the oldest lay nearly flat on the ground. In April, the usually solitary flowering stem grows at least 2 meters (2 yards) high from the rosette. The inflorescence is a panicle with about six branches. When in bloom, these branches are covered with small white six-parted flowers (Kral 1983; Wunderlin et al. 1980). Individual plants appear to usually have all male or all female flowers. This plant is not difficult to propagate because the plants bear abundant seeds

which are easily germinated. Several native plant nurseries are producing this species for sale.

Range and Population Level: The range of *Nolina brittoniana* is from the south end of Lake Wales Ridge in Highlands County north to Orange County (Orlando) and northern Lake County. An isolated locality has been reported from Hernando County, north of Tampa. On the Lake Wales Ridge, it occurs in both Highlands and Polk Counties in most of the tracts that are targeted for acquisition by the State or by the Fish and Wildlife Service. It may still occur in western Orange County and in the northwest corner of Osceola County where specimens were collected in 1958 but remaining habitat is being rapidly destroyed. In Lake County, it occurs in the remnants of high pine on hills west of Lake Apopka near Clermont.

Habitat: *Nolina brittoniana* occurs in scrub, high pine, and even occasionally in hammocks (Christman 1988).

Reasons for Current Status: Loss of habitat to agricultural and residential development is threatening this species. Sand pine scrub in central Florida was limited in extent even before at least 85 percent of it was converted to citrus groves or residential developments. This species appears to be locally abundant in intact vegetation. Conservation land acquisition underway by the State of Florida and by the Fish and Wildlife Service should adequately conserve this species in Highlands and Polk Counties. Current acquisition plans may not adequately protect it in outlying portions of its range (such as Lake County).

Management and Protection: In biological preserves, scrub beargrass probably requires less special management or demographic monitoring than some other endangered plants.

Summary: Britton's beargrass is known to occur in Highlands, Polk, Orange, Osceola, and Lake Counties, Florida. This species inhabits scrub, sandhills, and occasionally hammocks. This species is not currently known to exist on National Forest lands, but suitable habitat may exist on the Ocala National Forest. Major causes of population declines include agricultural and residential development, habitat fragmentation, and fire suppression (Federal Register Vol. 58(79): 25746-25755).

Godfrey's Butterwort (*Pinguicula ionantha*)

Status: Threatened, *Federal Register*, July 12, 1993

Description and Reproduction: The bladderwort family, a small family of carnivorous plants, is closely related to the

snapdragon family (Scrophulariaceae). Pinguicula ionantha has a rosette of fleshy, oblong, bright green leaves that are rounded at their tips with only the edges rolled upward. The rosette is about 15 cm (six inches) across. Short, sticky glandular hairs on the upper surfaces of the leaves capture insects. The flowers are borne on leafless stalks about 10-15 cm tall. A fully opened flower's corolla is about two centimeters (0.8 in.) across. The five corolla lobes are pale violet to white. The throat of the corolla and the corolla tube are deeper violet with dark violet veins. A yellow to olive spur four to five millimeters long is present on the corolla.

Range and Population Level: Godfrey's butterwort is found near the Gulf coast in the Florida panhandle between Tallahassee and Panama City (Godfrey and Wooten 1981, Florida Natural Areas Inventory 1989). It is locally abundant in Apalachicola National Forest.

Habitat: Pinguicula ionantha inhabits seepage bogs on gentle slopes, deep quagmire bogs, ditches, and depressions in grassy pine flatwoods and grassy savannas. It often occurs in shallow standing water (Godfrey and Stripling 1961). In Franklin County, it occurs at a savanna with a particularly rich flora, including Macbridea alba (white birds-in-a-nest) and Scutellaria floridana (Florida skullcap), both federally listed as threatened species.

Reasons for Current Status: This plant has a limited geographic distribution. Within its range, it has been collected or observed at only 20 localities. It is threatened by habitat degradation due to lack of prescribed fire and shading by planted pines. This plant does not tolerate shade and according to Kral (1983), canopy closure in pine plantations may result in loss or diminishment of the species until the next logging.

Management and Protection: The Forest Service will be able to incorporate management measures for Pinguicula ionantha into its planning and management systems, probably by formal agreement with the Fish and Wildlife Service. State and Federal land acquisition projects on the southern periphery of the National Forest will protect and restore a great deal of habitat for this species, possibly enough to allow its delisting. Principal private landowners can be notified of locations and the importance of protecting this species' habitat through several mechanisms, including Florida's system for protecting endangered and threatened species from pesticide (including herbicide) application, and Florida's procedures for regional and local planning.

Summary: Godfrey's butterwort is a carnivorous plant of the

bladderwort family, and is shade intolerant. This species occurs in Bay, Gulf, Franklin, and Liberty Counties, Florida including the Apalachicola National Forest. Godfrey's butterwort inhabits seepage bogs on gentle slopes, deep quagmire bogs, ditches, and depressions in grassy pine flatwoods and savannahs. Major threats to this species include intensive site preparation and planting, drainage modification including plowed fire lines, and fire suppression and the associated titi encroachment (Federal Register 58(131): 37432-37443).

Lewton's Polygala (Polygala lewtonii)

Status: Endangered, Federal Register, April 27, 1993

Description and Reproduction: Polygala lewtonii is a perennial herb with a taproot. Each plant produces one to several annual stems which are upward-curving, spreading or erect, and are often branched. The leaves resemble shingles because they are small, sessile, rather succulent, broader toward the tip, are borne upright, and tend to overlap along the stem. The normally open flowers are in erect, loosely flowered racemes up to 1.5 cm long. The flowers are about 0.5 cm long and are bright pink or an "attractive purplish-red" (Ward and Godfrey 1979). Each flower is about 3.5 mm long.

Range and Population Level: Lewton's polygala has been collected in Highlands, Polk, Osceola, Lake, and Marion Counties in central Florida (Wunderlin et al. 1981). In Polk County it is currently known to occur in Arbuckle State Forest and Park, the State's Catfish Creek land acquisition project, the Nature Conservancy's Tiger Creek Preserve, at a site near Davenport that was partly bulldozed in 1991, and in the Poinciana residential development. It also occurs at a site with the endangered Florida ziziphus (Ziziphus celata) (DeLaney et al. 1989). In Osceola County it was collected in 1974 at the northwest corner of the county on a dry prairie above Lake Davenport. In Lake County, the plant has been collected in scrub four miles north of Astatula and from at least five sites in the hills between Lake Apopka and Lake Clermont.

Habitat: Polygala lewtonii occurs most frequently in habitats intermediate between high pineland (i.e., longleaf pine on uplands) and scrub as well as in both habitats (Christman 1988).

Reasons for Current Status: Future real estate development is the primary threat to Lewton's polygala. Serious loss of habitat has already occurred due to agriculture (citrus groves and pastures) and residential development.

Management and Protection: High pineland in Ocala National Forest that is occupied by this species is probably appropriately managed for it as well as Eriogonum longifolium var. gnaphalifolium, another threatened species. State conservation land acquisition in Highlands and Polk counties will probably be adequate to at least downlist this species to threatened status, if appropriate management can be developed. Management of scrub and of high pineland is reasonably well understood, and The Nature Conservancy is experimenting with restoration of degraded high pineland in the Florida panhandle. Little thought has been given to management of intermediate habitats. Studies of the demography of Lewton's polygala will be necessary.

Summary: Small Lewton's Polygala occurs in Highlands, Polk, Osceola, Lake, and Marion Counties, Florida and is known to occur in the Ocala National Forest. The species inhabits scrub vegetation and longleaf pine sandhills. Major threats to this species include agricultural and residential development, habitat fragmentation, and fire suppression (Federal Register 58(79): 25746-25755).

American Chaffseed (Schwalbea americana)

Status: Endangered, Federal Register, September 29, 1992

Description: American chaffseed is an erect perennial herb with unbranched stems (or stems branched only at the base) with large, purplish-yellow, tubular flowers that are borne singly on short stalks in the axils of the uppermost, reduced leaves (bracts). The leaves are alternate, lance-shaped to elliptic, stalkless, 2 to 5 cm (1 to 2 inches) long, and entire. The entire plant is densely, but minutely hairy throughout, including the flowers. Flowering occurs from April to June in the South, and from June to mid-July in the North. Chaffseed fruits are long, narrow capsules enclosed in a sac-like structure that provides the basis for the common name. Fruits mature from early summer in the south to October in the North. Schwalbea is a hemiparasite (partially dependent upon another plant as host). Like most of the hemiparasitic Scrophulariaceae, it is not host-specific, so its rarity is not due to its preference for a specialized host. Although another species (S. australis) was once recognized, the genus Schwalbea is now considered to be monotypic.

Range and Population Level: Historically, Chaffseed occurred in fifteen states, including Alabama, Connecticut, Delaware, Florida, Georgia, Kentucky, Maryland, Massachusetts, Mississippi, New Jersey, New York, North Carolina, South Carolina, Tennessee and Virginia at a total of approximately 78 sites. One historic record from Louisiana is now

considered to have been erroneous. Currently, 51 populations are known, including one in New Jersey, one in North Carolina, 43 in South Carolina, 4 in Georgia, and 2 in Florida. Chaffseed was never considered to be common, but populations have declined and the range has seriously contracted in recent decades. The species can no longer be found in 10 of the states in which it occurred historically. Many historic populations have been confirmed extirpated due to habitat destruction, primarily due to development. Others have been lost in the absence of habitat destruction, probably as a result of fire exclusion.

Habitat: American chaffseed occurs in sandy (sandy peat, sandy loam), acidic, seasonally moist to dry soils. It is generally found in habitats described as open, moist pine flatwoods, fire-maintained savannas, ecotonal areas between peaty wetlands and xeric sandy soils, and other open grass-sedge systems. Chaffseed is dependent on factors such as fire, mowing, or fluctuating water tables to maintain the crucial open to partly-open conditions that it requires. Historically, the species existed on savannas and pinelands throughout the coastal plain and on sandstone knobs and plains inland where frequent, naturally occurring fires maintained these sub-climax communities. Under these conditions, herbaceous plants such as Schwalbea were favored over trees and shrubs.

Most of the surviving populations, and all of the most vigorous populations, are in areas that are still subject to frequent fire. These fire-maintained habitats include plantations where prescribed fire is part of a management regime for quail and other game species, army base impact zones that burn regularly because of artillery shelling, forest management areas that are burned to maintain habitat for wildlife including the endangered red-cockaded woodpecker, and various other private lands that are burned to maintain open fields. Fire may be important to the species in ways that are not yet understood, such as for germination of seed, or in the formation of the connection to the host plant.

Reasons for Current Status: American chaffseed has been eliminated from two-thirds of the states where it was historically reported to occur. The most serious threats to its continued existence are fire-suppression, conversion of the habitat for commercial and residential purposes, and incompatible agriculture and forestry practices. The loss of periodic fire from the landscape seems to be the most serious factor in its decline. Residential and commercial development adjacent to populations can also pose a threat since urbanization generally results in fire suppression.

Management and Protection: Most of the remaining populations are in South Carolina, on privately-owned plantations that are managed for quail and other game species. It is believed that the regular prescribed burning used to manage these lands has also provided and maintained the preferred habitat for this endangered plant. Populations located on Federal lands, including Fort Bragg military reservation in North Carolina and the Francis Marion National Forest in South Carolina are being protected and managed for the benefit of the species. The U.S. Forest Service in South Carolina, in cooperation with The Citadel, is conducting prescribed burning and transplantation experiments. Additional research into the species' life history and management requirements is underway at Ichauway Plantation (the Joseph Jones Ecological Research Center) in Georgia. Preliminary genetic analyses are underway at the University of Georgia.

Summary: Twenty extant populations of American chaffseed are found in Florida, Georgia, Mississippi, New Jersey, North Carolina, and South Carolina. The species has been extirpated from Alabama, Connecticut, Delaware, Kentucky, Maryland, Massachusetts, New York, Tennessee, and Virginia. American chaffseed inhabits open, moist pine flatwoods, savannahs, and transition zones between peaty wetlands and xeric sandy soils. The species appears to be shade intolerant. The primary reasons for population declines include habitat destruction due to development and fire suppression (Federal Register 57(189): 44703-44708).

Navasota Ladies'-Tresses: (Spiranthes parksii)

Status: Endangered (47 FR 19539; May 6, 1982) without critical habitat

Description and Reproduction: This member of the orchid family (Orchidaceae) is an erect, slender-stemmed perennial herb 8-15 inches tall. The roots are clusters of tubers. The linear leaves are arranged in a rosette, and are absent during flowering. Flowers are in a spiral arrangement on the stalk, giving the plant its generic name. Conspicuously white-tipped bracts occur underneath each 0.25 inch long flower. Flower petals are rounded or ovate, side petals have a green central stripe, and the lip (bottom petal) is distinctly ragged.

Habitat: Occurs primarily in moist sandy soils in small openings amongst Post Oak Savanna vegetation associated with the Navasota and Brazos River drainages.

Distribution: In Texas populations are known to occur in Brazos, Burleson, Freestone, Grimes, Jasper, Leon, Madison, Robertson, and Washington Counties. Historic-unknown.

Threats and Reasons for Decline: Habitat loss and degradation due to development, road construction, mining, limited range, low numbers, and possible predation (browsing by deer).

Other Information: Almost all known populations occur on privately owned lands (except two populations that occurs on Lick Creek Park in College Station, Texas and population in Jasper County, Texas on U.S. Forest Service lands). This orchid buds in early to late October, flowers from mid-October to mid-November, and forms fruit from late October to the first frost (late-November). Each fruit normally contains thousands of microscopic seeds. This species is not cultivated very easily.

Summary: Navasota ladies'-tresses is known from only a few locations in Brazos County, Texas and one location in the Angelina National Forest. Fire suppression has affected this species (Federal Register Vol. 45(119): 41326-41328). This species is associated with post oak flats and should not be effected by RCW management.

Gentian Pinkroot (Spigelia gentianoi gentianoides)

Status: Endangered, Federal Register, November 26, 1990

Description and Reproduction: A perennial herb with a single, erect, sharply ridged stem 10 to 30 centimeters (4-12 inches) tall. The leaves are opposite and sessile, largest at the top of the stem, 3 to 5 centimeters (1 to 2 inches) long. Flowers are borne at the top of the stem in a few-flowered, spikelike raceme. The flowers, mounted on very short stalks, point upward. Sepals are 4 to 6 millimeters long. The corolla is 2.5 to 3 centimeters long, consisting of a narrow tube about 1 centimeter long, broadening to a wider tube with five lobes, each 5 to 6 millimeters long. The corolla is pale pink, slightly darker at the margins of the lobes. The stamens stay inserted within the flower (Kral 1983). The corolla lobes tend to stay nearly closed, with five slits opening between the lobes, but the flowers do open completely (George Rogers, Missouri Botanical Garden, pers. comm. 1989). The flower resembles those of gentians, which is the reason for the plant's name. Flowering is in May and June.

The closest relative of Spigelia gentianoides is pinkroot, Spigella marilandica, a widespread species that grows in clumps rather than as single stems and has brilliant red flowers (Kral 1983).

Range and Population Level: This species was first collected by A.W. Chapman before the Civil War, from the west side of the Apalachicola River, probably in Jackson County and

Mariana, Jackson County. One specimen is labelled "Quincy. 1836, not seen since.", but the date is incorrect, so the locality is unreliable. Ferdinand Rugel collected the plant near Mount Vernon (now Chattahoochee, Gadsden County) in 1843 (K. Wurdack, in litt. 1988).

The University of Florida herbarium has specimens (verified by Rogers [pers. comm. 1989]) from Chipley, Washington County (1940 and 1941), and from 8 miles north of Wewahitchka, Calhoun County (1954). Harry Ahles and David Boufford found one locality in Jackson County in 1973 (Wunderlin et al. 1980). A specimen from Gulf Hammock (Levy County), labelled by its collectors as Spigelia gentianoides, has been determined to be S. loganioides (R. Wunderlin, University of South Florida, pers. comm. 1988). Godfrey (1979) included Liberty County, Florida in the distribution of this plant.

Recently, Gary Knight, Robert Kral, Angus Gholson, Jr., Wilson Baker, and Kenneth Wurdack relocated one population and found two more (Rogers 1988a, 1988b; Gholson, pers. comm. 1989). Rogers, Robert Bowden (Director of Horticulture, Missouri Botanical Garden) and others revisited the populations in 1989. One population, in Jackson County, had about 30 plants in 1988, one fifth as many as it had 12 years earlier. The second, near the Jackson-Bay County line, has no more than 10 plants (Rogers, pers. comm. 1988). The third population is somewhat larger than the others.

Habitat: Gentian pinkroot occurs in mixed pine-hardwood forest, but the largest known population is in a longleaf-wiregrass woods, drier than flatwoods but apparently not a longleaf-turkey oak site. At this site, logging and replanting of pines resulted in full sunlight, at least until the young pines provide shade. Pinkroot plants at the site had sturdy stems and flowered, while plants at a shaded site appeared spindly, indicating that this species may actually prefer sun (Rogers, pers. comm. 1989; Bowden, in litt. 1990). Prescribed fire in a mixed hardwood-pine forest may have benefitted the pinkroots.

Reasons for Current Status: This may have been a locally common species in the early nineteenth century. It may not have been difficult to find as late as 1941 – label information on herbarium specimens is skimpy. The plant seems not to have been collected between 1954 and 1973, and Robert Kral, an expert and persistent field worker, had located the plant only once. The plant is definitely extremely rare now. In the absence of information on its habitat requirements, it is premature to give an explanation for the decline of gentian pinkroot. The species may be native to the wiregrass understory of longleaf pinelands, in which case the destruction of such vegetation for cotton

fields, along with twentieth century forestry practices on sites that weren't cleared may have severely affected the species.

Michaux's Sumac (Rhus michauxii)

Status: Endangered, Federal Register, September 28, 1989

Description: Michaux's sumac or false poison sumac is a densely hairy shrub with erect stems which are 1 to 3 feet in height. The shrub's compound leaves are narrowly winged at their base, dull on their tops, and veiny and slightly hairy on their bottoms. Each leaf is finely toothed on its edges. Flowers are greenish-yellow to white and are 4-5 parted. Each plant is unisexual. With a male plant the flowers and fruits are solitary, with a female plant all flowers are grouped in 3 to 5 stalked clusters. The plant flowers from April to June; its fruit, a dull red drupe, is produced in October and November.

Range and Population Level: Once known from three States, Georgia, South Carolina, and North Carolina, this plant now has viable populations only in North Carolina. Just four plants still survive in Elbert County, Georgia. Previously, this plant was known from five Georgia counties: Cobb, Columbia, Elbert, Newton, and Rabun. Reintroduction efforts are underway at some of the historic sites. In South Carolina, two populations of the plant were historically known; now, the plant is considered extirpated from that State. Currently, the plant survives in the following North Carolina Counties: Richmond (6 populations); Hoke (3 populations); Scotland (2 populations); Franklin (1 population); Davie (1 population); Robeson (1 population); and Wake (1 population). It has been eliminated from Durham, Moore, Orange, Randolph, Wilson, Lincoln, and Mechlenberg Counties. Of the 15 existing populations in North Carolina, nine have less than 100 plants each, and three of these have less than a dozen plants each.

Habitat: Michaux's sumac grows in sandy or rocky open woods in association with basic soils. Apparently, this plant survives best in areas where some form of disturbance has provided an open area. Eleven of the plant's 16 remaining populations are on highway rights-of way, roadsides, or on the edges of artificially maintained clearings. Two other populations are in areas with periodic fires, and two more populations exist on sites undergoing natural succession. One population is situated in a natural opening on the rim of a Carolina bay.

Reasons for current status: Perhaps the most crucial factor endangering this species is its low reproductive capacity.

Only two of the plant's 16 remaining populations have both male and female plants. The apparent low genetic variability of the species, caused by geographic isolation, complicates this situation. In response to the proposed listing of this species as endangered, The North Carolina Natural Heritage Program wrote: . ". . . because of the clonal nature of this species and the scarcity of populations containing both male and female plants, the remaining populations may actually consist of only about two dozen genetic individuals (Department of the Interior 1989)." Hybridization of this plant with Smooth sumac (*Rhus Copallina*) and Dwarf sumac (*Rhus glabra*) is another threat to the plant's genetic integrity. In at least two historic sites of Michaux's sumac, hybrid plants (apparently crosses between *Rhus glabra* and *Rhus michauxii*) have been found (Hardin and Phillips 1985). The plant is also threatened by fire suppression and habitat destruction due to residential and industrial development. Two of the plant's historic populations were destroyed by development, one by the construction of a water tower, and one by the conversion of the site to pine plantation.

Management and Protection: The plant is shade-intolerant, and some form of disturbance, such as burning, is necessary to control the growth of woody species around its habitat. Timber harvesting and road construction or maintenance should be carefully conducted to preserve this plant's habitat. Prescribed burning is being conducted at the North Carolina Sandhills Game Lands which has the largest population (137 plants). Genetic analysis work is being done through a cooperative effort between the University of Georgia, the North Carolina Nature Conservancy, and the U.S. Fish and Wildlife Service's Asheville, North Carolina, Field Office. Researchers from the University of Georgia will analyze tissue samples collected from the remaining North Carolina and Georgia populations, for their genotypes. If possible, male or female plants may be reintroduced into unisex populations of compatible genotypes (Nora Murdock, Asheville Field Office, personal communication, 1990). The first reintroduction attempt, conducted in Georgia in cooperation with the Georgia Heritage Inventory and Woodlanders, a commercial nursery specializing in native plants, is doing well with good survival of transplanted material.

Management and Protection: One small population is on State-managed land, where managers will have to adopt a cautious experimental approach to habitat management. Prescribed fire, already tried, may be beneficial. It is not known at present what might be done to protect or manage the largest known population, on private land planted to pines.

Mammals

Of the seven species of mammals included in the Forest Service's Biological Assessment, the red wolf, Florida panther, and eastern cougar are not currently known to exist on National Forest lands. However, suitable habitat for these species does occur and therefore potential effects are disclosed. Primary reasons for endangerment include habitat loss, habitat fragmentation, and direct mortality from shooting or road kills (Federal Register 1992; USDI 1982a, 1987, 1989).

Red Wolf (Canis rufus)

Status: Endangered, Federal Register, March 11, 1967

Description: A medium-sized, wild canid, the red wolf resembles the coyote but is larger and more robust. Its legs and ears are relatively longer than the coyote's. The red wolf's coloration is similar to that of the coyote, but the tawny element is more pronounced, and the pelage is usually somewhat coarser. This species is slightly smaller than the gray wolf (C. lupus) with a more slender and elongated head. It's pelage is shorter and coarser than in any race of lupus.

Prey studies in Texas and Louisiana, and more recent investigations in North Carolina, indicate that the diet of the red wolf will include whatever small to medium-sized mammals occur in abundance within the area in question. The last survivors in the wild in Texas and Louisiana fed primarily on nutria, rabbits, and carrion. Studies at Alligator River National Wildlife Refuge indicate not only a wide range of smaller mammals found on the refuge, but also a heavy dependance on white-tailed deer by red wolves released into the wild. Historical accounts indicate that prey could also include young calves and other smaller domestic animals.

Reproduction and Development: It is thought that red wolves mate for life. Breeding occurs in February and March, and pups are born in April and May. The average litter size is about 4.6 young. Our experiences, to date, indicate that without veterinary care, pup mortality in the wild may be significant.

Red wolves have been known to establish dens in hollow tree trunks, stream banks, abandoned dens of other animals, drain pipes, and culverts. They have been known to excavate dens in sand knolls in coastal areas. Dens found excavated in the coastal plain region of Texas and Louisiana averaged about 8 feet in length and had an entrance diameter of about 2 to 2.5 feet. Two dens have been documented during reintroductions. One was beneath a rock outcrop, and the other was under hay

bales in a barn.

Both males and females take part in rearing the young. Frequently, young of the previous year have been found in the vicinity of dens, but they do not appear to participate in the guarding, feeding, or training of the pups. Red wolves apparently exist as small family units (packs) of an adult pair and their young. The offspring disperse at about 6 months of age.

Range and Population Level: The red wolf was once found throughout the southeastern United States, from the Atlantic coast to central Texas and from the Gulf Coast to central Missouri and southern Illinois. Between the period of 1900 to 1920, red wolves were extirpated from most of the eastern portion of their range. A small number persisted in the wild in southeastern Texas and southwestern Louisiana until the late 1970s. By 1980, the species was determined to be extinct in the wild.

The present red wolf population of at least 249 animals exists primarily in captivity. Two hundred (200) animals are located in 22 captive breeding facilities in the United States. The U.S. Fish and Wildlife Service has a major captive breeding project at Graham, Washington. This project is administered by contract with the Point Defiance Zoo in Tacoma, Washington. To date, there are 26 to 30 adult and yearling red wolves in the wild at the Fish and Wildlife Service's Alligator River National Wildlife Refuge in North Carolina; there are 16 animals in the wild at the Great Smoky Mountains National Park in Tennessee. Also, there are seven animals in the wild on three islands managed as propagation projects.

Habitat: The last red wolves were found in coastal prairie and marsh habitat because this was the last area in which the animals were allowed to remain. Any habitat area in the southeastern United States of sufficient size, which provides adequate food, water, and the basic cover requirement of heavy vegetation, should be suitable habitat for the red wolf. Telemetry studies indicate that red wolf home range requirements vary from about 25 to 50 square miles.

Reasons for Current Status: Expanding human populations and extensive land clearing initially affected the red wolf in two ways. First and probably foremost, these animals, along with other large predators, were killed in great numbers. Second, the extensive clearing of forest and hardwood river bottoms eliminated much of the prime red wolf habitat. The disappearance of the last red wolves from the wild is attributed to two factors: habitat changes which favored expansion of the historic coyote range into red wolf

territory, and the local breakdown of red wolf social structure (caused by extensive trapping, poisoning, and shooting). The resulting situation of unmated red wolves in close proximity to coyotes apparently encouraged interbreeding. Competition with the more adaptable coyote and parasitic infections such as mange, hookworms, and heartworms, are of secondary importance in the final decline of the species.

Management and Protection: A limited red wolf recovery program was first initiated in 1967. With the passage of the Endangered Species Act of 1973, an expanded program to save this species was initiated by the U.S. Fish and Wildlife Service, in cooperation with the Louisiana Department of Wildlife and Fisheries and the Texas Parks and Wildlife Department. In November 1973, as part of the overall red wolf recovery program, the Fish and Wildlife Service entered into an agreement with the Metropolitan Park Board of Tacoma, Washington, to initiate a red wolf captive breeding program at the Point Defiance Zoo in Tacoma. The objectives of this program were to certify the genetic purity of wild-caught wolves, and to breed animals

for future reintroduction into the wild and/or distribution to selected captive breeding facilities. By late 1975, it was concluded that red wolves could not be maintained in their limited range in Texas and Louisiana. Therefore, recovery efforts were directed toward exploring the feasibility of using captive stock to reestablish red wolf populations in other areas of the species' historic range. With this decision, a final effort was made to capture as many of the remaining red wolves in the wild as possible.

To evaluate problems associated with a full-scale reintroduction program, an experimental reintroduction involving a single pair of wolves was conducted in December 1976 on Bulls Island, at the Cape Romain National Wildlife Refuge in South Carolina. One of the wolves swam to the mainland 9 days after its release, and both animals were recaptured and returned to the captive breeding program. The acclimation period was extended to 6 months, and on January 5, 1978, another pair of red wolves was released onto Bull's Island. No problems were encountered, and the pair was allowed to remain free until the following October when they were recaptured and found to be in good health. The longer acclimation period was considered to be the primary reason for the success of this experiment.

After evaluating numerous potential reintroduction sites, an effort to establish a permanent population of red wolves in the wild was attempted from 1982 to 1984 on the Tennessee Valley Authority's Land Between the Lakes. This particular

site, located in southwestern Kentucky and northwestern Tennessee, contains about 170,000 acres of land that is owned by the Federal Government. A reintroduction proposal was developed and coordinated with the State wildlife agencies of Kentucky and Tennessee. Public meetings were held in both States during November and December, 1983. Along with other unexpected problems, opposition by special interest groups ultimately prompted both of the State wildlife agencies to reject the proposal "as submitted."

A second attempt to establish a permanent population was initiated in 1987. The site was the then new Alligator River National Wildlife Refuge in Dare County, North Carolina. The North Carolina Wildlife Resources Commission approved the project, but elected to remain neutral in the execution of the effort. After considerable contact with local individuals and organizations, and after four public meetings in the project area, four pairs of red wolves were taken from captivity and released during the fall of 1987. Some of these adult animals died within 6 months, but others survived. Pups, including second generation pups, have been born in the wild. At the moment there are 26 to 30 adult and yearling free-ranging red wolves and an unknown number of pups on the refuge. This project has proceeded beyond expectations. Public support continues to be positive. All of these originally released animals and their offspring are locally designated as experimental nonessential under provisions of Section 10(j) of the Endangered Species Act. This project will be expanded west of Alligator River by releasing one to two family groups in 1993 into the Pocosin Lakes National Wildlife Refuge.

The recovery goal for this species is defined in the Red Wolf Recovery Plan as "at least three disjunct, wild populations." The recovery goal is further defined as approximately 220 animals in the wild and 330 in captivity. Each major reintroduction will require a minimum land area of about 225 square miles (144,000 acres), and some potential reintroduction sites will have resident coyote populations. The ability of the red wolf to retain its genetic integrity in the presence of a coyote population, assuming otherwise favorable circumstances, is presently unknown. The final answer can only be determined by actual trial.

One trial was initiated in November 1991, when a pair of adult red wolves and their offspring were released into the Cades Cove section of the Great Smoky Mountains National Park in Tennessee. This release was a 1-year experiment to determine the feasibility of establishing a red wolf population in the south Appalachians. Results were favorable, and a permanent reintroduction was initiated by releasing two family groups into the park in the fall of

1992. Both adult pairs reproduced successfully in 1993, and the current population is 16 animals, including 7 pups. All released animals and offspring are designated as experimental nonessential.

Florida Panther (Felis concolor coryi) (Bangs)

Status: Endangered throughout its range, Federal Register, March 11, 1967.

Description: The Florida panther is a large, long-tailed cat with a great deal of color variation: pale brown or rusty upper parts, dull white or buffy under parts; tail tip, back of ears, and sides of nose are dark brown or blackish. Mature male panthers examined in the wild in Florida since 1978 have weighed from 102 to 154 pounds (Roelke 1990; Roelke and Glass 1992) and measured nearly 7 feet from nose to tip of tail. Females were considerably smaller, with a weight range of 50 to 108 pounds (Roelke 1990) and measuring about 6 feet (U.S. Fish and Wildlife Service 1987).

Feeding Habits: Preliminary analyses of panther diets in the southwest Florida study area indicate that panthers subsist on a variety of mammalian prey dominated by white-tailed deer, wild hog, and in some areas raccoon. Analysis of 83 scats and 22 kills since 1986 indicate a difference in food habits between the north and south portions of the study area. Deer and hogs accounted for 42 percent and 22 percent, respectively, in the south, and 23 percent and 63 percent, respectively, in the north. Occurrence of small prey appeared similar between areas (Maehr 1988b).

Reproduction and Development: Only preliminary data is available on Florida panther reproduction. Existing data indicates that breeding may occur throughout the year with a peak in the winter/spring period, a gestation period of around 90 to 95 days, litter sizes of 1 to 4 kittens, and a breeding cycle of 2 years for females successfully raising young to dispersal, which occurs around 18 to 24 months. A female has successfully reproduced at 22 to 23 months, and a male has possessed fertile sperm and exhibited reproduction at 26 to 30 months, (Belden 1988; Maehr 1988a; Roelke 1986; O.L. Bass and D.S. Maehr, pers. comm.)

Male panthers examined to date exhibit an exceedingly high proportion of abnormal sperm forms (more than 90 percent), with the major defect involving the acrosome or head of the spermatozoa. In addition, 12 of 27 males (44 percent) examined between 1981 and 1990, exhibited unilateral cryptorchidism - one testicle does not descend properly into the scrotum (Roelke 1990). As of June 1993, sixty-five percent (11 of 17) of living males were cryptorchid. Concern

over this condition heightened in 1992, when 2 male kittens were found to be bilaterally cryptorchid (neither testicle descends), rendering them functionally sterile (Roelke and Glass 1992).

As part of the genetic preservation effort, a sperm bank was established in 1988 to cryopreserve (freeze-store) semen collected from free-ranging males.

Data on development indicate that at 12 to 14 days of age, kitten weights ranged from 1 pound, and 4 ounces, to 1 pound and 12 ounces, and at 21 days weights were around 4 pounds. Males 6 to 10 months of age weighed 33 to 66 pounds; 14 to 19 months, 85 to 86 pounds; and 24 to 36 months, 92 to 93 pounds. Females 4 to 6 months weighed 25 to 39 pounds; 6 to 10 months, 33 to 49 pounds; 14 to 20 months, 56 to 70; and 24 to 48 months, 50 to 80 pounds (Roelke 1990, Roelke and Glass 1992).

Range and Population Level: The historic range included eastern Texas or western Louisiana and the lower Mississippi River valley east through the Southeastern States in general (Arkansas, Louisiana, Mississippi, Alabama, Florida, Georgia, and parts of Tennessee and South Carolina) (Young and Goldman 1946). Even though numerous sighting reports continue to surface annually throughout its historic range, it is unlikely that viable populations of the Florida panther presently occur outside Florida. The only known self-sustaining population occurs in south Florida, generally within the Big Cypress Swamp physiographic region and centered in Collier and Hendry Counties. Within the last decade, radio-instrumented panthers have also utilized habitats in Broward, Dade, Glades, Highlands, Lee, and Monroe Counties. Scattered verified sign has been documented (late 1980's) along the St. Johns River drainage (Belden and Frankenberger 1988) from northern Okeechobee County north to southern Putnam County (Belden, pers. comm. 1989). Currently, the wild population is estimated to be comprised of 30 to 50 adult animals.

Habitat: In general, panther population centers appear to indicate a preference toward large remote tracts with adequate prey, cover, and reduced levels of disturbance. A telemetry study on the Florida panther was initiated in south Florida by the Florida Game and Fresh Water Fish Commission (Commission) in 1981. This initial study has since been expanded by the Commission, and the National Park Service initiated additional studies in 1986. One of the goals of these telemetry projects is to learn more about panther habitat. As of June 1993, data had been gathered from 54 radio-instrumented panthers.

Data from panthers monitored by the Commission in southwest Florida since 1985 indicate that, overall, habitat use is highly diverse and varies from north to south. Diversity of habitats used by panthers is greater in northern parts of the study area and dominated by uplands (hardwood hammocks, low pinelands, and palm forests). Lower diversity and predominately wetland habitat use are characteristic of southern areas (mixed swamp and cypress swamp). Appropriate cover is an important component of habitats used, especially during hunting, denning, and day-bedding. Saw palmetto was the dominant cover in 72 percent of observed day bedding sites.

Annual home-range sizes of 26 instrumented panthers monitored in southwest Florida varied from 20 to 457 mi^2. Home ranges averaged 200 mi^2 for resident adult males, 75 mi^2 for adult females, 241 mi^2 for transient males, and 69 mi^2 for subadult females (Maehr et al. 1991).

Management and Protection: The initial recovery plan was prepared by the Florida Panther Recovery Team and was approved by the Fish and Wildlife Service on December 17, 1981. This plan was revised by the Florida Panther Interagency Committee's Technical Subcommittee and approved by the Fish and Wildlife Service on June 22, 1987. The recovery objective, as presented in the revised plan, is to achieve three viable, self-sustaining populations within the historic range of the panther. This is to be accomplished through three principal sub-objectives:

1. Identify, protect, and enhance existing panthers rangewide and protect and manage habitats;

2. Establish positive public opinion support for the management of the panther; and,

3. Reintroduce panthers into areas of suitable habitat.

Implementation of many of the recovery plan's tasks is presently underway. Some tasks have already been completed. Ongoing recovery actions primarily focus on protecting and enhancing the existing wild population, developing and implementing genetic management strategies (which includes the management of a captive breeding population), and locating candidate reintroduction sites and developing reintroduction technologies that will lead to successful population reestablishment programs in other historic range areas. A Habitat Preservation Plan for panther habitat in south Florida was completed in July 1993. A rangewide candidate reintroduction site identification and evaluation project is underway and should be completed during 1993. Genetic restoration strategies presently under consideration

include a program to reinstitute gene flow into the panther from an adjoining subspecies, as occurred naturally prior to isolation. The primary thrust of the recovery effort is being generated through the Florida Panther Interagency Committee (Committee). This Committee was organized in 1986 to ensure that the principal agencies assigned lead roles in recovery implementation (U.S. Fish and Wildlife Service, National Park Service, Florida Game and Fresh Water Fish Commission, and Florida Department of Natural Resources) initiate and implement all recovery activities in a cooperative and coordinated manner.

Eastern Cougar (Felis concolor, couguar)

Status: Endangered throughout its range, Federal Register, June 4, 1973

Description: The eastern cougar is described as a large, unspotted, long-tailed cat. Its body and legs are a uniform fulvous or tawny hue. Its belly is pale reddish or reddish white. The inside of this cat's ears are light-colored, with blackish color behind the ears. Sometimes the cougar's face has a uniformly lighter tint than the general hue of the body (DeKay 1842). Cougars feed primarily on deer, but their diet may also include small mammals, wild turkeys, and occasionally domestic livestock, when available.

Reproduction and Development: Observations of the western subspecies suggest that cougars begin breeding when 2 or 3 years old and breed thereafter once every 2 to 3 years. Whether or not there is a definite breeding season is a matter of contention. Courtship is initiated by the female and generally includes mating with a number of males. Spotted kittens weighing 8 to 16 ounces are born after a gestation period of about 3 months. Litter size is usually three. The kittens attain a weight of approximately 10 pounds in 8 weeks, and may weigh 30 to 45 pounds at 6 months. By the time they are yearlings they may weigh 60 to 90 pounds.

Range and Population Level: Historic records indicate that the eastern cougar once occurred from eastern Canada southward into Tennessee and South Carolina, where its range merged with that of the Florida panther (F. c. coryi). Present United States distribution is limited to only a few scattered areas at best. Recently there have been some sightings reported in Minnesota and Michigan. These individuals are believed to have originated from around New Brunswick or Manatoba, Canada (Bob Downing, pers. comm. 1991). In the Southeast Region, there have been a number of sightings, but the best evidence for a small permanent population has come from the Great Smoky Mountain National

Park Region. Based on a National Park Service study that included both sighting reports and field observations, there were an estimated three to six cougars living in the park in 1975 (Culbertson 1977). Sightings have also be reported in three other North Carolina areas including the Nantahala National Forest, the northern portion of the Uwharrie National Forest, and the State's southeastern counties. The remaining population of this species is extremely small; exact numbers are unknown.

Habitat: No preference for specific habitat types has been noted. The primary need is apparently for a large wilderness area with an adequate food supply. Male cougars of other subspecies have been observed to occupy a range of 25 or more square miles, and females from 5 to 20 square miles.

Reasons for Current Status: The eastern cougar has been hunted and trapped relentlessly as a pest. Much of its habitat has been eliminated through extensive deforestation, and its primary prey, the white-tailed deer, has suffered significant population and range reductions.

Management and Protection: The Fish and Wildlife Service and the U.S. Forest Service jointly completed a 5-year survey in an attempt to determine the presence of self-sustaining cougar populations in the southern Appalachian Mountains from Virginia to Northern Georgia. The primary survey method was to search for cougar tracks in the snow, especially in remote areas such as closed sections of the Blue Ridge Parkway. Other utilized techniques were scent stations using cougar urine, catnip, or other scents, and recorded sounds such as cougar screams, predator calls, and deer bleats. Although many promising leads were pursued, no concrete evidence was ever obtained for the existence of eastern cougar populations.

One of the more promising ways to positively determine if cougars are present is to collect and analyze scats (fecal droppings). A technique has been developed at Mississippi State University for identifying predator scats by thin layer and gas chromatography analysis of the various bile acids they contain.

Gray Bat (*Myotis grisescens*)

Status: Endangered throughout its range, *Federal Register*, April 28, 1976

Description: The largest member of its genus in the eastern United States, the gray bat weighs from 7 to 16 grams. Its forearm ranges from 40 to 46 millimeters in length (U.S. Fish and Wildlife Service, 1982). One feature which distinguishes

this species from all other eastern bats is its uni-colored dorsal fur. The other bats have bi- or tri-colored fur on their backs. Also, the gray bat's wing membrane connects to the foot at the ankle instead of at the base of the first toe, as in other species of Myotis (U.S. Fish and Wildlife Service 1982). For a short period after molt in July or August, gray bats are dark gray; but their fur usually bleaches to russet between molts. This difference in fur color is especially apparent in females during their reproductive season in May or June. Little is known about the actual feeding habits of gray bats. However, limited observations indicate that the majority of insects eaten are aquatic species, particularly mayflies.

Reproduction and Development: Upon arrival at their wintering caves in early fall, the mature females enter estrus and are inseminated by sexually active males. The offspring, one per female, are born the following June when the colonies have migrated to their summer range. The period from birth to weaning covers about 2 months. During this time the colonies are usually segregated into maternity caves, where the young are reared, and into bachelor caves which house the adult males and yearlings of both sexes. By August, all of the juveniles are flying and there is a general mixing and dispersal of the colony over the summer range. Fall migration begins around the first of September and is generally complete by early November.

Range and Population Level: Populations are found mainly in Alabama, northern Arkansas, Kentucky, Missouri, and Tennessee, but a few occur in northwestern Florida, western Georgia, southwestern Kansas, south Indiana, south and southwestern Illinois, northeastern Oklahoma, northeastern Mississippi, western Virginia, and possibly western North Carolina. Distribution within range was always patchy, but fragmentation and isolation of populations have been a problem over the past 3 decades.

The gray bat population was estimated to be about 2.25 million in 1970; however, in 1976 a census of 22 important colonies in Alabama and Tennessee revealed an average decline of more than 50 percent (Tuttle, unpubl. MS). Due to protective increases taken at high priority colony sites in the late 1970's and throughout the 1980's, the declines have been arrested at some major sites and those populations are now stable or in some cases are increasing.

Habitat: Gray bat colonies are restricted entirely to caves or cave-like habitats. During summer the bats are highly selective for caves providing specific temperature and roost conditions. Usually these caves are all located within a kilometer of a river or reservoir. In winter they utilize

only deep, vertical caves having a temperature of 6-11 degrees Centigrade. Consequently, only a small proportion of the caves in any area are or can be used regularly. There are nine known caves that are believed to house roughly 95 percent of the hibernating population.

One-way migrating distance between winter and summer caves may vary from as little as 10 miles to well over 200. Banding studies indicate the bats occupy a rather definite summer range with relation to the roosting site and nearby foraging areas over large streams and reservoirs. Summer colonies show a preference for caves not over 1.2 miles from the feeding area.

Reasons for Current Status: Gray bat colonies roost only in caves and cave-like habitats. Human disturbance and vandalism may have been primarily responsible for the decline. Disturbance of a maternity colony may cause thousands of young to be dropped to the cave floor where they perish; excessive disturbance may cause a colony to completely abandon a cave. Other factors which contributed to the decline included pesticide poisoning, natural calamities such as flooding and cave-ins, loss of caves due to inundation by man-made impoundments, and possibly a reduction in insect prey over streams that have been degraded through excessive pollution and siltation. Improper cave gating or cave commercialization have also contributed to some population declines.

Management and Protection: Blowing Wind Cave in northern Alabama, the most important summer cave known for gray bats, has been acquired by the U.S. Fish and Wildlife Service and a gate has been placed across the entrance. Fern Cave, the largest known gray bat hibernaculum, has also been purchased by the Fish and Wildlife Service and is being managed for protection of the bats. Many other measures have been taken for protection of this species throughout its range. Some additional conservation measures needed include: (1) purchase and protection, through proper gating and restricted usage, of other gray bat caves; (2) education of spelunkers and other cave visitors who may unintentionally disturb the species; and, (3) continuation of Federal efforts to reduce persistent pesticides in the environment.

Indiana Bat (Myotis sodalis) (Miller and Allen)

Status: Endangered throughout its range, Federal Register, March 11, 1967

Description: The Indiana bat is a medium-sized myotis, closely resembling the little brown bay (Myotis lucifugus) but differing in coloration. Its fur is a dull grayfish

chestnut rather than bronze, with the basal portion of the hairs of the back dull lead colored. This bat's underparts are pinkish to cinnamon, and its hind feet smaller and more delicate than in M. lucifugus. The calcar (heel of the foot) is strongly keeled.

Little is known of the this bat's diet beyond the fact that it consists of insects. Females and juveniles forage in the airspace near the foliage of riparian and floodplain trees. Males forage the densely wooded area at tree top height (LaVal et al. 1976, 1977).

Range and Population Level: The Indiana bat occurs in the Midwest and eastern United States from the western edge of the Ozark region in Oklahoma, to southern Wisconsin, east to Vermont, and as far south as northern Florida. In summer it is apparently absent south of Tennessee; in winter it is apparently absent from Michigan, Ohio, and northern Indiana where suitable caves and mines are unknown. About 500,000 individuals of this species still exist.

Reproduction and Development: This bat has a definite breeding period that usually occurs during the first 10 days of October. Mating takes place at night on the ceilings of large rooms near cave entrances. Limited mating may also occur in the spring before the hibernating colonies disperse.

Hibernating colonies disperse in late March and most of the bats migrate to more northern habitat for the summer. However, some males remain in the hibernating area during this period and form active bands which wander from cave to cave.

Limited observations indicate that birth and development occur in very small, widely scattered colonies consisting of 25 or so females and their young. Birth usually takes place during June with each female bearing a single offspring. About 25 to 37 days are required for development to the flying stage and the beginning of independent feeding.

Migration to the wintering caves usually begins in August. Fat reserves depleted during migration are replenished largely during the month of September. Feeding continues at a diminishing rate until by late November the population has entered a definite state of hibernation.

The hibernating bats characteristically form large, tight, compact clusters. Each individual hangs by its feet from the ceiling. Every 8 to 10 days hibernating individuals awaken to spend an hour or more flying about or to join a small cluster of active bats elsewhere in the cave before returning to hibernation.

Habitat: Limestone caves are used for winter hibernation. The preferred caves have a temperature averaging 37 degrees to 43 degrees Fahrenheit in midwinter, and a relative humidity averaging 87 percent. Summer records are rather scarce. A few individuals have been found under bridges and in old buildings, and several maternity colonies have been found under loose bark and in the hollows of trees. Summer foraging by females and juveniles is limited to riparian and floodplain areas. Creeks are apparently not used if riparian trees have been removed. Males forage over floodplain ridges and hillside forests and usually roost in caves. Foraging areas average 11.2 acres per animal in midsummer.

Critical Habitat: The following caves have been designated as Critical Habitat within the Southeast Region:

Tennessee:	White Oak Blowhole Cave, Blount County
Kentucky:	Bat Cave, Carter County
	Coach Cave, Edmonson County

Reasons for Current Status: The decline is attributed to commercialization of roosting caves, wanton destruction by vandals, disturbances caused by increased numbers of spelunkers and bat banding programs, use of bats as laboratory experimental animals, and possibly insecticide poisoning. Some winter hibernacula have been rendered unsuitable as a result of blocking or impeding air flow into the caves and thereby changing the cave's climate. The Indiana bat is nearly extinct over most of its former range in the northeastern states, and since 1950, the major winter colonies in caves of West Virginia, Indiana, and Illinois have disappeared. A high degree of aggregation during winter makes the species vulnerable. During this period approximately 87 percent of the entire population hibernates in only seven caves.

Management and Protection: The original Indiana bat recovery plan was approved in 1976, and a revised plan was approved on October 14, 1983, Some of the major recovery goals include: (1) Preserving critical winter habitat by securing primary caves and mines and restricting entry; (2) Initiating an information and education program; and, (3) Monitoring population levels and habitat (to include an evaluation of pesticide effects).

To date, the primary conservation efforts have been to control access of people by the installation of properly designed gates across cave entrances. Some gating has already been accomplished on Federal and State lands. Gating of all seven of the major wintering hibernacula would provide protection for about 87 percent of the population. Some privately-owned caves in Missouri and West Virginia are being

negotiated for public acquisition. The National Speological Society and the American Society of Mammologists are taking measures within their respective organizations to promote conservation of the Indiana bat.

Virginia Big-eared Bat (Plecotus townsendii virginanus)

Status: Endangered, Federal Register, November 30, 1979

Description: Plecotus townsendii is a medium-sized bat with forearms measuring 39 to 48 millimeters (mm) long and weighing 7 to 12 grams. Total body length is 98 mm, the tail is 46 mm, and the hind foot is 11 mm long. This bat's long ears (over 2.5 centimeters) and facial glands on either side of the snout are quite distinctive. Fur is light to dark brown depending upon the age of the individual and the subspecies. The only other eastern bat that resembles the Virginia big-eared bat is P. rafinesquii (Rafinesque's big-eared bat). Rafinesque's big-eared bat has toe hairs that extend beyond the end of the toes and the dorsal fur is gray rather than brown. The belly fur of Rafinesque's big-eared bat is white or whitish rather than light brown or buff (Schmidly 1991, Barbour and Davis 1969). Copulation occurs in the fall and winter and the females store the sperm until ovulation in late winter or spring. Gestation takes about 3 months and a single pup is born in May or June. Development is fairly rapid and the young are on their own within 2 months (Barbour and Davis 1969, Schmidly 1991, Kunz and Martin 1982).

Three additional subspecies of P. townsendii have been described. Of these P. t. townsendii (Pacific western big-eared bat) is found along the Pacific coast from Northern California to Washington, and P. t. pallescens (pallid western big-eared bat) is a light colored race found in the desert areas of the Southwest (Barbour and Davis 1969). The third subspecies of Plecotus townsendii is P. t. australis which does not occur in the United States. It is only known from Mexico and Central America.

Range and Population Level:

The Virginia big-eared bat is known from four states. The species' current county distribution and population estimates follow:

(1) West Virginia (Pendleton, Grant and Tucker Counties) - 7356.
(2) Virginia (Tazewell County) - 2200.
(3) Kentucky (Lee Counties) - 3850.
(4) North Carolina (Avery County) - 160.

The current population of the Virginia big-eared bat population is estimated to be 13,566 individuals.

Habitat: The Virginia big-eared bat utilizes caves year-round as roost sites. During the winter, most populations hibernate in a few cold caves that provide optimum temperatures for hibernation. In Kentucky and North Carolina, roost site temperatures in December, January, and February range from 2.5 degrees Centigrade to 9.5°C. During the summer, females congregate in warm maternity caves to raise their young. Roost site temperatures probably range from 15°C to 18°C in these maternity caves. The males apparently disperse into smaller groups separate from the females during the summer.

Reasons for Current Status: The primary reason for the present endangered status of this species is disturbance and vandalism at their cave and nine roost sites. Disturbance during hibernation results in an increased use of stored fat reserves and, if intense or frequent enough, can result in direct or indirect mortality. Disturbance at maternity sites can result in direct mortality of the young or the movement of maternity colonies from optimum to marginal summer roost sites. Predation at cave entrances by feral house cats, raccoons, screech owls, bobcats, and snakes may also be a factor in the decline of the species (U.S. Fish and Wildlife Service 1984).

Management and Protection: Summer and winter roost sites for the Virginia big-eared bat have been gated or fenced in North Carolina, Virginia, and West Virginia. Protection of these sites has resulted in stopping or reversing the population declines that the summer and winter roost sites experienced before protection. Studies are underway in Kentucky, Virginia, and West Virginia to determine the foraging and summer habitat requirements of the Virginia big-eared bat.

Louisiana Black Bear (*Ursus americanus luteolus*)

Status: Threatened, *Federal Register*, January 7, 1992

Description: The Louisiana black bear is one of sixteen recognized subspecies of the American black bear *U. americanus* (Hall 1981). This species was formerly widespread in North America, from northern Alaska, including Newfoundland, south to central northern Mexico (Lowrey, 1981). The Louisiana black bear is distinguished from other black bears by possessing a skull that is longer, more narrow, and flat, and by possessing proportionately large molar teeth (Nowak 1986). Black bears are huge, bulky mammals with long black hair. Although weight varies considerably, large males may weigh more than 600 pounds.

Biological Information: The Louisiana black bear is a habitat generalist and often overwinters in hollow cypress trees either in or along sloughs, lakes, or riverbanks in bottomland habitats of the Tensas and Atchafalaya river basins. These bears are mobile, opportunistic, largely herbivorous omnivores that exploit a variety of foods and closely track phenological development. The distribution and abundance of foods, particularly mast, largely affects their movements. The size of an individual's range or area it traverses annually to secure food and mates and to care for young, is probably directly related to the diversity of vegetative cover, or habitats. Constituent elements of black bear habitat include hard and soft mast, escape cover, denning sites, corridor habitats, and some freedom from disturbance by man.

Reproduction and Development: While some females may breed at 3 years of age, it is likely that most don't breed until 4 years of age (Smith 1983). Based on testicular measurements (Smith, 1983), males probably reach sexual maturity at 3 years of age. Females of breeding age in the nearby St. Francis River bottoms of Arkansas had a mean breeding interval of 2.5 years (Smith 1983). Parturition in black bears has generally been assumed to occur in late January or early February with the actual birthing often occurring while the female is in hibernation. Litter size ranges from one to three.

Habitat: The black bear was considered numerous at the time of early colonization, serving as food both for Indians and white settlers (Lowrey 1981). White man's occupation of the land, hunting, and ultimately habitat destruction through conversion of the virgin forests for farming combined to bring about the decline of the Louisiana black bear. The Louisiana black bear is now restricted primarily to the Tensas and Atchafalaya River Basins in Louisiana. These bears make long range movements and not uncommonly occur in adjacent Mississippi. Additionally, recently, one verified sighting was made in eastern Texas (private land in Sabine County) and four valid, but unverified sightings were made in Sabine and Shelby Counties. However, it is unknown whether breeding numbers exist outside of Louisiana. The Louisiana black bear's occupied habitat consists primarily of bottomland hardwood timber found in its river basin habitats.

Management and Protection: Black bears are featured as priority species for protection and management on the Tensas and Atchafalaya River National Wildlife Refuges, State-owned lands, and on certain important privately-owned tracts, such as Deltic Farms near Tallulah, Louisiana. Additionally, important research on basic life history questions is occurring on the Tensas River National Wildlife Refuge and in

the lower Atchafalaya River basin. The Louisiana black bear's threatened status warrants protection under sections 7 and 9 of the Endangered Species Act. The State of Louisiana has increased fines for illegal killing of bears. The Black Bear Conservation Committee (BBCC), a coalition of private and public interests formed to insure the necessary private landowner cooperation to restore the bear, promotes numerous private and public initiatives to insure conservation of this species.

Summary: The historical range of the Louisiana black bear included eastern Texas, Louisiana, and southern Mississippi. The Louisiana black bear is known to exist on the De Soto National Forest and may exist on the Homochitto National Forest. Both of these forests are in southern Mississippi. Reasons for listing include habitat loss and direct mortality from shooting (Federal Register Vol. 57(4):588-595).

Birds

American Peregrine Falcon (*Falco peregrinus anatum*) (Bonaparte)

Status: Endangered throughout its range, *Federal Register*, June 2, 1970; October 13, 1970; March 20, 1984

Description: This bird is a medium-sized raptor with long, pointed wings and a long tail. The adult is slate gray; its wing, tail feathers, and flanks are barred with black. Black moustache marks exist on the side of the face, and its throat is white. Coloring for the lower part of the body is white and reddish buffy, extensively spotted and barred with black. The legs and feet are yellow. Immature birds are brown above, streaked below. The American peregrine is larger, darker, and has more extensive black markings on the face than the Arctic peregrine (*F. p. tundrius*).

Feeding Habitats: Other common avian species of small to medium size serve as the falcon's prey. Its diet includes bluejays, flickers, meadowlarks, pigeons, starlings, shorebirds, waterfowl, and other readily available species. Peregrines usually hunt their prey in air, diving at speeds of up to 200 miles per hour to strike the quarry. The prey is either struck to the ground or killed outright by the blow from the falcon's talons. Peregrines may fly 10 to 12 miles from their nest in search of prey. The prey species are usually hunted over open habitat types such as waterways, fields, and wetland areas such as swamps and marshes.

The original eastern United States population of the peregrine, which was extirpated, was considered by most ornithologists to be non-migratory. However, in order to

find better feeding conditions, there was apparently some fall/winter movement from the mountains to the coast. The birds returned to their normal breeding area in the spring.

Reproduction and Development: Falcons generally reach sexual maturity at 3 years of age. In the East, pairs were usually on their breeding grounds and had reestablished territories by March. Eggs were laid during late March and April with the clutch size usually being three or four eggs, but rarely six or seven. In the event the first clutch was lost early in the season, a second clutch was laid. Incubation lasts about 33 days with a 2-day hatching interval between eggs. The female normally does most of the incubating while the male hunts. Young stay in the nest for 6 to 7 weeks and are not self-sufficient for several months. Hatching success in the wild is about 75 percent, with an average of one young reaching fledgling age per laying pair. Juvenile birds continue to be particularly vulnerable during their first year of life as they learn to hunt and develop flying skills.

Range and Population Level: The American peregrine falcon breeds from non-Arctic portions of Alaska and Canada south to Baja California (except on the coast of southern Alaska and in British Columbia), central Arizona and Mexico (locally); eastern limits presently follow the eastern front of the Rocky Mountains in the United States. Distribution is local in the southern boreal forests of Canada and a few pairs still breed in Labrador. This falcon winters chiefly in its breeding range, except that the more northern birds move south. The former breeding range also included Ontario, southern Quebec, the Canadian Maritime Provinces, and the eastern United States, south to northern Georgia. Currently, there may be 500 to 600 peregrine pairs in the western United States; but, based on a 1975 survey, the original eastern population has been extirpated. In the early 1940's, the eastern United States' population was roughly estimated at 350 pairs. As a result of a captive breeding program, a total of 1,178 peregrines have been reintroduced into the Northeast. This breeding program was first established and run by the Peregrine Fund Inc., at Cornell University. Since 1986, the Peregrine Fund and the breeding program have been headquartered in Boise, Idaho. In 1990, there were a total of 84 territorial pairs, 58 laying pairs, and 45 successful pairs producing 111 young.

Habitat: A cliff or series of cliffs that tends to dominate the surrounding landscape constituted typical nesting habitat in the eastern United States. However, other forms of nesting habitat have also been utilized, such as river cutbanks, trees, and manmade structures including tall towers and the ledges of tall buildings.

Reasons for Current Status: The principal cause of the peregrine's decline has been due to the presence of chlorinated pesticides, especially DDT and its metabolite DDE, which have accumulated in peregrines as a result of feeding on contaminated prey. Adult mortalities have increased but the principal effect has been damage to the reproductive potential through interference with calcium metabolism. Eggs were laid with thin shells, rendering them easily broken, and consequently, greatly affecting the species' reproductive success. Other less significant factors in the decline include shooting, natural predators (the great horned owl in particular), egg collecting, disease, falconers, human disturbance at nesting sites, and loss of habitat to human encroachment.

Management and Protection: A comprehensive recovery plan was completed in 1979, and revised in 1987. The primary objective of the plan is to restore a self-sustaining population of peregrine falcons in the eastern United States. The goal is to attain a successful, sustained, nesting population in the wild at a level of 50 percent of the numbers estimated to have occurred in the 1940's, or to a level which the present environment will support. In addition, a minimum of 20 to 25 nesting pairs should be attained in each of five regions where this bird will be released. The plan recommends that this be accomplished by: (1) preserving and providing nesting habitat; (2) restoring the peregrine population through the introduction of captive-produced birds; (3) preserving migration and wintering habitat; and, (4) providing protection for the birds.

A captive breeding program was initiated at by the Peregrine Fund at Cornell University beginning with the 1971 breeding season. The peregrines being used for this work include some *F. p. anatum* birds as well as several other subspecies. As of 1990, approximately 1,178 falcons had been released in 11 northeastern states. Releases are decreasing now, and will likely end in 1992 or 1993. The current focus is on nest protection and population monitoring.

Summary: Nesting habitat for the peregrine falcon may occur on the Daniel Boone National Forest. Many southern national forests occur within known migration corridors of wintering peregrine falcons. Forests with RCWs may provide wintering habitat for falcons. Pesticides and shooting are the primary reasons for peregrine falcon population declines in the past (USDI 1979).

Mississippi Sandhill Crane (*Grus canadensis pulla*) (Aldrich)

Status: Endangered throughout its range, *Federal Register*, June 4, 1973

Description: Mississippi sandhill cranes resemble great blue herons (Ardea herodias). A major distinguishing characteristic is that cranes are completely gray. Great blue herons usually have white on their heads and dark colored underparts. When standing erect, cranes are about 4 feet tall. Male and female cranes are similar in appearance. All cranes have long necks, and adult cranes possess a bald red forehead. The species vocalizations are loud and clattering. Cranes are also unique in that they require separate nesting, foraging, and roosting habitats (U.S. Fish and Wildlife Service 1991).

Crane feeding habits vary with the seasons. In the summer, the birds feed upon the natural foods found in swamps, savannas, and open forests. These include adult and larval insects, earthworms, crayfish, small reptiles, frogs and other amphibians, and possibly small birds and mammals. Cranes also consume roots, tubers, nuts, seeds, fruits, and leaves. During the other three seasons, the birds eat small corn and chufa, an introduced plant. In the early fall, cranes usually feed on corn until the kernels become scarce. Chufa is used year round. Pecans are often eaten from September through December.

Reproduction and Development: Although some nesting occurs in forested areas, most takes place in open savannas and swamp openings. These areas vary from dry to being covered in shallow water. Nests are constructed on the ground of vegetation gathered in the immediate vicinity.

Paired cranes select a breeding territory for courtship, mating, and nesting, and may defend it from other cranes. Territory size probably depends on the quality and type of the habitat, the age of the paired cranes, and the population density of other cranes. Only one pair of birds has been observed to nest during a season in each open savanna; but, where clearings are separated by forested areas, cranes have nested within one-half mile of each other. Nesting territories are generally used for more than 1 year, some for 10 to 17 years. Cranes also tend to reuse nests for up to 3 consecutive years. When new nests are constructed, they are often located close to the previous nests (U.S. Fish and Wildlife Service 1991).

The age of sexual maturity for the Mississippi sandhill is thought to be 3 or 4 years of age. Females become active a year or so later than males. Data is available showing that Mississippi sandhill cranes first lay eggs between the ages of 3 to 6 years (U.S. Fish and Wildlife Service 1991). Frequently, these cranes will raise only one chick a year. Hatching begins in April, peaks during the first 3 weeks of May, and ends by mid-August. An August hatching may be the

result of renesting. Data through 1988 indicates that 73 of a total 142 wild eggs have hatched or 51 percent. However, since 1982, hatching success has apparently declined. Information was compiled for 70 eggs that failed to hatch. Most of the eggs, a total of 43, failed because of infertility or other unknown causes. Only
11 subadult Mississippi sandhill cranes have been spotted during the winter since 1980. This supports the theory that the species productivity has been low (U.S. Fish and Wildlife Service 1991).

Range and Population Level: The Mississippi sandhill crane is one of six sandhill crane subspecies. Three subspecies, the lesser sandhill crane (*G. c. canadensis*), the greater sandhill crane (*G. c. tabida*), and the Canadian sandhill crane (*G. c. rowani*) are northern, migratory forms which nest in northern North America and the Soviet Union, but overwinter in Mexico and in the southern United States from Texas through Florida. A fourth subspecies, the cuban sandhill (*G. c. nesiotes*) is nonmigratory and nests in Cuba. Two other subspecies, The Florida (*G. c. pratensis*) and the Mississippi sandhill are also nonmigratory and nest in the Southeastern United States (U.S. Fish and Wildlife Service 1991). These two subspecies are part of the southern family of *Grus canadensis*, which once occurred in small, scattered populations along the Gulf coastal plain from Louisiana to Florida. In fact, until 1972 all resident United States cranes were considered a single subspecies, *G. c. pratensis*. Comparisons between Florida, Georgia, and Mississippi sandhill cranes led to Aldrich's declaration of the Mississippi sandhill crane as a separate subspecies. He described the Mississippi sandhill cranes as "consistently much darker" than the Florida or Georgia birds (Aldrich 1972). Remnant sandhill crane populations in Alabama and Georgia probably are related to Florida sandhill cranes. Historic populations in eastern and western Louisiana and Texas may have been related to the Mississippi sandhill crane.

Scattered populations of the Florida sandhill crane still exist. Although Williams (1978) believes that populations in the panhandle may have been extirpated, he estimated the Florida population at about 4,000 birds. Most Mississippi sandhill cranes survive on the Mississippi Sandhill Crane National Wildlife Refuge in Jackson County, Mississippi. Its present range is restricted to the Pascagoula River (east), to the Jackson County line (west), to about Simmons Bayou (south), to 4 miles north of the town of Vancleave (north) (U.S. Fish and Wildlife Service 1991). Less than 100 wild Mississippi sandhill cranes are believed to survive.

Habitat: Savannas are the preferred habitat of the Mississippi sandhill crane and are inhabited year round. These wet grasslands are predominated by wiregrass (Aristida spp.) with scattered longleaf pine (Pinus palustris), slash pine (P. elliottii), and cypress (Taxodium ascendens) trees. Other associated plants include pitcher plants (Sarracenia spp.), sundew (Drosera spp), clubmoss (Lycopodium alopecuroides), and pipeworts (Eriocaulon spp.). Cranes also utilize wooded depressions (swamps or ponds) dominated by cypress, longleaf, and slash pine trees with an understory of swamp cyrilla (Cyrilla racemiflora), buckwheat tree Cliftonia monophylla), wax myrtle (Myrica cerifera), and several species of holly (Ilex spp.) (U.S. Fish and Wildlife Service 1991).

Critical Habitat: This species' designated Critical Habitat covers about 26,000 acres. All known breeding, summer feeding, and roosting sites are included. Scattered winter feeding areas are located on farmland to the north of critical habitat zone. These sites cover a large area, and their sporadic use varies with the crops.

Critical Habitat includes areas of land, water and airspace within Jackson County, Mississippi with the following components (St. Stephens Base Meridian): T6S R6W Sec. 31; T6S R7W E1/2 of E1/2 Sec. 34, Sec. 35-36, S1/2 Sec. 38; T6S, R8W Sec. 27, those portions of Sec. 28-31 south of Seaman Road, Sec. 32-34; T7S R6W N1/2 of N1/2 Sec. 3, Sec. 6.; T7S R7W Sec. 2-11, Sec. 13-16, Sec. 20-22, W1/2 Sec. 23, W1/2 of E1/2 Sec. 23, NE1/4 of NE1/4 Sec. 23, N1/2 of N1/2 Sec. 24, that portion of the SW1/4 of SW1/4 Sec. 30 south of the Louisville and Nashville Railroad, W1/2 of W1/2 Sec. 31, W1/2 Sec. 37, that portion of the E1/2 Sec. 37 north of U.S. Interstate Highway 10; T7S R8W Sec. 1-3, that portion of Sec. 4 north of U.S. Interstate Highway 10, Sec. 5-6, those portions of Sec. 7-8 north of U.S. Interstate Highway 10, Sec. 10-12, W1/2 of W1/2 Sec. 14, Sec. 15, that portion of Sec. 25 south of the Louisville and Nashville Railroad, that portion of the SE1/4 of Sec. 26 south of the Louisville and Nashville Railroad and southeast of Davis Bayou, N1/2 of NE1/4 Sec. 35, Sec. 36.

Reasons for Current Status: With population estimates of less than 100 birds since 1929, the Mississippi sandhill crane's status has always been precarious. During the 1950's thousands of acres of the crane's favored savanna habitat were drained and converted to slash pine plantations. Dense understories developed underneath the mature pine trees, and the once open, undisturbed habitat became unsuitable for cranes. Commercial and residential development also progressed, and the human population increased. Eight paved highways now transect or border the crane's range. These

roads have further depleted habitat, caused pollution problems, and eased public access to the cranes. Sporadic crane shootings were reported in the 1960's and 1970's. In addition, roadsides are usually sprayed with herbicides or other pollutants. Until recently, fire ants were eliminated with Mirex. A dead crane was discovered in 1974 with Mirex residues in the breast muscle and brain.

Five of the cranes necropsied by the Patuxent Wildlife Research Center since 1981 have had tumors. Suspected causes have been infectious viruses or parasites, naturally occurring toxins, and genetic predisposition (U.S. Fish and Wildlife Service 1991). The crane's susceptibility to tumors may have resulted from a decrease in genetic variability. Low genetic variability may also be responsible for a decrease in hatching success, and for deformities in the captive population. Natural causes, such as flash floods, hurricanes, and droughts, have also caused some deaths.

Management and Protection: Most of the current crane population and its habitat is protected on the 19,273-acre Mississippi Sandhill Crane National Wildlife Refuge. The Grand Bay National Wildlife Refuge has been acquired southeast of the original refuge, and a second population of cranes may be introduced there if more land can be obtained.

A captive population was established at the Patuxent Wildlife Research Center in Laurel, Maryland. Developed with wild Mississippi sandhill crane eggs, the captive population numbered 32 adults in 1989. Captive releases to the Mississippi Sandhill Crane Refuge began in 1981, and by 1983 there were 13 free-flying captive-raised cranes on the refuge. A total of 96 captive-raised cranes had been released by 1989, and 53 of these had survived. By 1990, eight captive-raised cranes had attempted to nest.

Recovery goals as outlined in the Mississippi Sandhill Crane Recovery Plan are: (1) Cessation of the need for captive-raised cranes; (2) attainment of a free-living stable, and self-sustaining population which demonstrates stability and self-sustenance for at least 10 continuous years, and (3) establishment of enough habitat to support the crane population. A stable, free-living population will be defined from continually updated research and population models. This population must represent the complete range of genetic variability available in the Mississippi sandhill crane gene pool.

Summary: The Mississippi sandhill crane's range is limited to Jackson County, Mississippi, including portions of the De Soto National Forest. The preferred habitat is wet pine savannahs and open pine forests. There is potential for RCW

management to effect crane habitat. Primary reasons for declines of Mississippi sandhill crane include habitat loss and modification caused by drainage, intensive site preparation and planting, and fire suppression (USDI 1990a).

Bald Eagle (Haliaeetus leucocephalus) (Linnaeus)

Status: The bald eagle is endangered throughout the 48 conterminous States except for the populations in Washington, Oregon, Minnesota, Wisconsin, and Michigan which are classified as threatened (Federal Register, March 11, 1967; February 14, 1978). Recently, the U.S. Fish and Wildlife Service published advance notice of a proposal to reclassify or delist the bald eagle (Federal Register, February 7, 1990). Now, the U.S. Fish and Wildlife Service is reviewing information indicating that the bald eagle has recovered in a portion of its range to determine if it should be reclassified from endangered to threatened. A formal proposal is expected shortly.

Description: A large raptor, wingspread about 7 feet, plumage mainly dark brown with pure white head and tail when adult. First year juveniles are often chocolate brown to blackish, sometimes with white mottling on the tail, belly, and underwings. The head and tail become increasingly white with age until full adult plumage is reached in the 5th or 6th year. An opportunistic predator, the bald eagle feeds primarily on fish but also takes a variety of birds, mammals, and turtles (both live and as carrion) when fish are not readily available.

Reproduction and Development: The breeding season of bald eagles varies with latitude. The general tendency is for winter breeding in the South with a progressive shift toward spring breeding in northern locations. In the Southeast, nesting activities generally begin in early September; egg laying begins as early as late October and peaks in late December.

The female does most of the nest construction, but the male assists. The typical nest is constructed of large sticks with softer materials such as dead weeds, cornstalks, grasses, and sod added as nest lining. Bald eagle nests are very large, up to 6 feet in width and weighing hundreds of pounds. Many nests are used year after year.

Eagles may lay from 1 to 3 eggs, but the usual clutch is two eggs. A second clutch may be laid if the first is lost. Incubation lasts 34 to 38 days. The young fledge 9 to 14 weeks after hatching but parental care may continue for another 4 to 6 weeks. Bald eagles reach sexual maturity at 4 to 6 years. Life span is not known, but it is potentially

long since eagles have lived for 50 years in captivity.

Range and Population Level: The bald eagle is found throughout North America from northern Alaska and Canada, south to southern California and Florida. Breeding occurs throughout the same area. Nesting in the Southeast occurs in three primary areas: peninsular Florida, coastal South Carolina and coastal Louisiana; with sporadic breeding in the rest of the Southeastern States. Otherwise, bald eagles occur throughout the Southeast as migrating or over-wintering birds.

During 1990, occupied bald eagle territories in the lower 48 States were estimated to be 2,933. An occupied territory indicates activity in a nesting area by a pair of eagles, but it does not necessarily mean that the activity resulted in offspring. In the Southeast, the number of occupied territories in 1990 was 722; however, only 466 of those nests successfully fledged young. Bald eagle populations in the Southeast have increased over the last 10 years. In 1981, the number of eagle territories was estimated at 396. A few nests have been established in states that once had none (see table). These increases are believed to be a result of the successful hacking program undertaken in the Southeastern States. The following occupied nesting territories and recovery goals were reported by Southeastern State agencies for the 1990 nesting season.

STATES	OCCUPIED TERRITORIES 1981	1990	RECOVERY GOAL
Alabama	0	4	10
Arkansas	1	10	10
Florida	340	535	400
Georgia	3	8	20
Kentucky	0	7	5
Louisiana	18	45	40
Mississippi	0	3	10
North Carolina	0	7	10
South Carolina	21	59	40
Tennessee	0	15	15
Texas	13	29	40

Habitat: The bald eagle is primarily associated with coasts, rivers, and lakes, usually nesting near bodies of water where it feeds. Selection of nesting sites varies depending on the species of trees growing in a particular area. In the Southeast, nests are constructed in dominant or codominant pines or bald cypress. Nests are usually constructed in living trees, but bald eagles will occasionally use a dead tree. There are certain general elements which seem to be consistent among nest site selection. These include (1) the proximity of water (usually within one-half mile) and a clear flight path to a close point on the water, (2) the largest living tree in a span, and (3) an open view of the surrounding area. The proximity of good perching trees may also be a factor in site selection. An otherwise suitable site may not be used if there is excessive human activity in the area.

Bald eagle wintering areas possess many of the same characteristics as nest sites. However, the birds are not as closely limited to shores at this time, with both adults and immatures gathering food where it is most easily available. Roost sites are an important component of wintering areas. Eagles may roost singly or in groups exceeding a hundred birds.

Reasons for Current Status: The major factor leading to the decline of the bald eagle was lowered reproductive success following the introduction of the pesticide DDT in 1947. DDT residues caused eggshell thinning which lead to broken eggs. Use of DDT was suspended in 1972, and by the late 1970's eagle populations began to show signs of recovery. Currently, the most significant factor to affect the recovery of the bald eagle in the Southeast is habitat destruction and disturbance by humans. Additional factors in the decline include illegal shooting, electrocution, impact injuries, and lead poisoning.

Management and Protection: Protective measures instituted include legal and regulatory measures, captive rearing, and habitat protection and improvement. Bald eagles are protected by Federal laws enforced by the U.S. Fish and Wildlife Service and State Game Departments. Nests sites are protected under management programs on Federal lands.

Proposed management measures include continued surveys to determine nesting success and population trends, continued research on pesticide effects and other limiting factors, implementation of public information programs, and additional personal contacts with private land owners to obtain their cooperation in protecting the eagles and their nests.

The National Wildlife Federation, aided by an Exxon Corporation grant, set up a Raptor Information Center. An exhaustive, computerized bibliography of bald eagle information is available.

In 1983, the George M. Sutton Avian Research Center in Bartlesville, Oklahoma, was established as a center for bird conservation, education, and research. To date, the center has been actively involved in captive rearing and hacking of bald eagle chicks for distribution throughout the Southeastern Region. First clutch bald eagle eggs are removed from Florida nests and sent to the center for incubation and hacking. The Florida population is not harmed because females lay a second clutch. Chicks hatched at the Sutton Center are released in the Southeast to supplement the regional population. So far, the Sutton Center has successfully released 188 bald eagle chicks in the Southeast.
Summary: The bald eagle is found throughout the southeast. Nesting is limited primarily to peninsular Florida and to a much lesser extent the coastal areas and areas around large impoundments in Louisiana, Mississippi, South Carolina and Texas. Nesting habitat is generally associated with large bodies of water. The potential does exist for RCW management to occur in active or potential eagle nesting habitat. Habitat loss, fragmentation, and pesticides are the primary reasons for bald eagle population declines (USDI 1983c).

Reptiles

Eastern Indigo Snake (*Drymarchon corais couperi*)

Status: Threatened, *Federal Register*, January 31, 1979

Description: The eastern indigo snake is a large, docile, non-poisonous snake growing to a maximum length of about 8 feet. The color in both young and adults is shiny bluish-black, including the belly, with some red or cream coloring about the chin and sides of the head.

The indigo subdues its prey (including venomous snakes) through the use of its powerful jaws, swallowing the prey usually still alive. Food items include snakes, frogs, salamanders, toads, small mammals, birds, and occasionally young turtles.

Reproduction and Development: Indigo snakes probably reach sexual maturity at 3 to 4 years of age. Based on observations of captive indigos at Auburn University, mating begins in November, peaks in December, and continues into March. Clutches averaging eight to nine eggs laid in late spring hatch approximately 3 months later. The snakes remain active to some degree throughout the winter, often emerging

from their dens whenever air temperatures exceed 50 degrees Fahrenheit.

Range: This species is currently known to occur throughout Florida and in the coastal plain of Georgia. Historically, the range also included southern Alabama, southern Mississippi, and the extreme southeastern portion of South Carolina.

Habitat: The indigo snake seems to be strongly associated with high, dry, well-drained sandy soils, closely paralleling the sandhill habitat preferred by the gopher tortoise. During warmer months, indigos also frequent streams and swamps, and individuals are occasionally found in flat woods. Gopher tortoise burrows and other subterranean cavities are commonly used as dens and for egg laying.

The home range of indigos varies considerably according to season. Based on a study conducted in southwest Georgia, Speake et al. (1978) reported an average seasonal range of 4.8 hectares during the winter (December through April), 42.9 hectares during late spring or early summer (May through July), and 97.4 hectares during late summer and fall (August through November). The most extensive monthly movements occurred during August. Of a total of 108 den sites located, 77 percent were in gopher tortoise burrows, 18 percent were in or under decayed stumps and logs, and 5 percent were under plant debris. The study area included windrows of debris piled up in the 1960's during site preparation for a slash pine plantation. The snakes showed some tendency to prowl and locate their dens near these windrows.

Reasons for Current Status: The decline is attributed to a loss of habitat due to such uses as farming, construction, forestry, pasture, etc., and to over-collecting for the pet trade. The snake's large size and docile nature have made it much sought after as a pet. The effect of Rattlesnake Roundups on the indigo snake are speculative. Both indigos and rattlers utilize the burrows of gopher tortoises at certain times. Rattlesnake hunters often pour gasoline down these burrows to drive out the snakes. While some indigos may be killed by this practice, the actual degree of impact on the population is unknown.

Management and Protection: The ultimate recovery plan objective is to delist the species by insuring that numerous indigo snake populations exist and are reproducing and protected where suitable habitat still exists in the historical range of the species. Before these objectives can be accomplished, research is necessary to: (1) develop population monitoring methods; (2) determine habitat requirements of juveniles; and (3) determine captive breeding

and restocking potential of the species. Establishment of protected areas of good habitat as reintroduction sites and sanctuaries is thought to be important, as is the improvement of public attitude and behavior towards the indigo snake.

Recovery tasks currently being implemented include habitat management through controlled burning, testing experimental miniature radio transmitters for tracking of juvenile indigo snakes, maintenance of a captive breeding colony at Auburn University, recapture of formerly released snakes to confirm survival in the wild, presentation of education lectures and field trips, and efforts to obtain landowner cooperation in indigo snake conservation efforts.

Summary: The eastern indigo snake was historically found from extreme southeastern South Carolina, the coastal plains of Georgia, throughout Florida, southern Alabama and Mississippi. Currently the species is known to occur in Florida and Georgia. A reintroduction was made on the De Soto NF in Mississippi, however, its success or failure is unknown. Eastern indigo snakes occur in RCW habitat. They are closely associated with gopher tortoise burrows. Preferred habitats include open pine forests in flatwoods, dry glades, and sandhills. This species is often associated with longleaf pine - turkey oak forest types. Habitat loss and degradation caused by development, fire control, and hardwood encroachment, as well as collecting for the pet trade, are the primary reasons for population declines of the eastern indigo snake (USDI 1982). In one study, 94% of wintering eastern indigo snakes were located in gopher tortoise burrows, so a decrease in gopher tortoise population could also affect eastern indigo snake abundance.

Blue-tailed Mole Skink (Eumeces egregius lividus) and **Sand Skink** (Neoseps reynoldsi)

Status: Both skinks are threatened. Federal Register, November 6, 1987

Description and Reproduction:

Blue-tailed Mole Skink: The blue-tailed mole skink has a long cylindrical body with small legs. It grows to 9 to 15 centimeters (3 to 6 inches); the animal's body comprises somewhat less than half of its total length. Young skinks have blue tails which may turn pink with age or regeneration. Blue-tailed mole skinks eat fossorial invertebrates, generally roaches, spiders, and crickets. The life history of the blue-tailed mole skink is probably similar to the peninsular mole skink (Eumeces egregius onocrepis). Mole skinks usually reach sexual maturity during their first year, and they mate during the fall and winter. Females produce

three to seven eggs which are laid underground in the spring.

Sand Skink: A unique lizard adapted to an underground existence, the sand skink measures 10 to 13 centimeters (4 to 5 inches) in length and has a gray to tan color. Its forelegs are tiny and bear only one toe; its hindlegs are small and have two toes. The tail comprises about half of the animal's total length. The sand skink has a wedge-shaped head, a partially countersunk lower jaw, body grooves into which the forelegs can be folded, and small eyes which have transparent windows in the lower lids. These features enable the lizard to swim beneath the surface of loose sand. The diet of this species consists of surface-dwelling invertebrates, including beetle larvae, termites, spiders, and larval antlions. Sand skinks host three endemic endoparasites: two flagellate protozoans, _Monocercomonas neosepsorum_ and _Rigidomastix scincorum_, and an undescribed oxyurid nematode species, _Thelandros_ sp. (Telford 1959).

Range and Population Level:

Blue-tailed Mole Skink: Restricted to Polk and Highlands Counties in Florida, the blue-tailed mole skink occurs at many of the same sites as the sand skink. North of Polk County, the blue-tail is replaced by the peninsular mole skink (_Eumeces egregius onocrepis_), or by intergrades with that subspecies (Mount 1965; Christman 1978). Only 20 sites for the blue-tail are recorded by the Florida National Areas Inventory. However, it may occur at some additional scrub and sandhill habitat sites, including Lake Kissimee State Park, Lake Arbuckle, Saddle Blanket Lakes, and Tiger Creek.

Sand Skink: The sand skink occurs in Marion, Lake, Orange, Polk, and Highlands Counties, Florida. Records kept by the Florida Natural Areas Inventory indicate that the species occurs at a minimum of 31 sites. However, all of these sites have been reduced to only a portion of their original size. The species also may occur at Lake Arbuckle State Park and Wildlife Management Area in Polk County.

Habitat:

Blue-tailed Mole Skink: Sand pine scrub and sandhill areas support the blue-tailed mole skink. Unlike the sand skink which is dispersed throughout suitable habitat areas, the blue-tailed mole skink exists in localized pockets under surface litter (Christman 1978). The moisture found under surface litter may be important for thermoregulation, nesting, and feeding. Mole skinks forage for food on the surface or up to 5 centimeters (2 inches) underground. Although blue-tailed mole skinks are frequently found with sand skinks under surface litter, the two species usually

live in different microhabitats and do not compete for food.

Sand Skink: The sand skink exists in areas vegetated with sand pine (*Pinus clausa*)-rosemary (*Ceratiola ericoides*) scrub or a longeleaf pine (*Pinus palustris*)-turkey oak (*Quercus laevis*) association. Food supply and moisture are important factors in the species' selection of habitat. Sand skinks are most frequently found in the ecotone between rosemary scrub and palmetto-pine flatwoods where moisture is present beneath the surface litter, e.g., bark, and in sand starting at a depth of 2 centimeters or 1 inch (Telford 1959). The species usually remains underground and burrows 5 to 10 centimeters beneath the soil to find its nourishment.

Reasons for Current Status: Habitat destruction is the primary threat to both species' survival. Citrus groves, and residential, commercial, and recreational facilities have depleted the xeric upland habitat of both skinks. In the southern Lake Wales ridge where most of the sand skink's and all of the blue-tailed mole skink's habitat still remains, 64 percent of the area was developed by 1981 (Peroni and Abrahamson 1985). Fire suppression or land use changes pose secondary threats to the species. Lack of periodic fire in sand pine scrub and longleaf pine communities, without a substitute means of controlling succession, will eventually turn these communities into scrub or hardwoods making them unsuitable for the sand skink and blue-tailed mole skink. An additional 10 percent of this area has been moderately disturbed. The skinks and 12 federally listed plants face further threats as the citrus industry continues to move southward following the severe winter freezes of 1984 and 1985. Although both skinks are considered threatened by the Florida Game and Fresh Water Fish Commission (Chapter 39-27, Florida Administrative Code), the legislation does not provide any direct habitat protection.

Management and Protection: The sand skink receives some protection at each of the following seven sites:

Ocala National Forest in Marion County - Distribution is spotty but the sand skink occurs on several sites.

Lake Louisa State Park in Lake County - Less than 50 acres of suitable habitat remains.

Tiger Creek Preserve in Polk County - Owned by The Nature Conservancy, this site supports several hundred acres which may be suitable for the sand skink.

Archbold Biological Station in Highlands County - 2,400 acres of this 3,900-acre private research institution are xeric habitats inhabited by the sand skink in varying densities

(Dr. James N. Layne, pers. comm.)

Wekiwa Springs State Park in Orange County - Several hundred acres of xeric habitat may be available for the species.

Saddle Blanket Lakes Preserve in Polk County - Owned by The Nature Conservancy, this site includes only about 55 acres of scrub. However, the State of Florida may acquire about 750 additional nearby acres under its Conservation and Recreation Land Program.

Bok Tower Nature Preserve in Polk County - Sand skinks and blue-tailed mole skinks have recently been discovered on about 20 acres of this site (Dr. I Jack Stout, pers. comm.).

Where the sand skink and blue-tailed mole skink co-exist in scrub habitats the blue-tailed mole skink is much less numerous (Dr. Steve Christman, pers. comm.). Also, much of the mole skink's range occurs on private lands. Some of the protected lands where the mole skink is likely to occur include Saddle Blanket Lakes, Tiger Creek, Archbold Biological Station. Lake Kissimmee State Park, and Lake Arbuckle. The Florida Department of Natural Resources and The Nature Conservancy are trying to acquire scrub habitat to support these skinks and other listed species. On newly acquired sandhill and scrub habitats, well-drained sands with open areas free of rooted vegetation may be beneficial for both species. Campbell and Christman (1982) found that the sand and mole skink populations in Ocala National Forest were most abundant in early successional stages of sand pine scrub. Clear-cutting and even-age stand management of sand pines in Ocala appear to have maintained the conditions equivalent to the natural fire regime (1 to 8 years). Although both skinks benefit from the opening and clearing of sand pine communities, it may be important to leave widely scattered surface litter when clear-cutting.

Summary:

Blue-tailed Mole Skink: The blue-tailed mole skink is known only from Polk, Highlands, and Osceola Counties, Florida. This species is not known to occur on National Forest lands, but uses habitats similar to the sand skink which occurs on the Ocala National Forest. Suitable habitat includes sand pine scrub and longleaf pine-turkey oak communities. Primary reasons for decline include habitat loss due to agricultural and residential development (Federal Register Vol. 58(87): 27307-27308).

Sand Skink: The sand skink occurs in Highlands, Polk, Osceola, Orange, Lake, and Marion Counties, Florida, including the Ocala National Forest. Suitable habitat

includes sand pine scrub and longleaf pine-turkey oak communities. Primary reasons for decline include habitat loss due to agricultural and residential development (Federal Register Vol. 58(87): 27307-27308).

Gopher Tortoise (Gopherus polyphemus)

Status: Threatened in Louisiana, Mississippi, and west of the Tombigbee and Mobile Rivers in Alabama (Federal Register, July 7, 1987).

Description: The gopher tortoise is a large, (shell 15 to 37 centimeters or 5.9 to 14.6 inches long) dark-brown to grayish-black terrestrial turtle with elephantine hind feet, shovel-like forefeet, and a gular projection beneath the head on the yellowish, hingeless plastron or undershell (Ernst and Barbour 1972). The sex of individual turtles can usually be determined by shell dimensions. A male turtle has a greater degree of lower shell concavity, and a longer gular projection. However, the sex of tortoises at maturity size is difficult to determine (U.S. Fish and Wildlife Service 1990).

This turtle feeds primarily on grasses, grass-like plants, and legumes. Its diet may also include mushrooms, fleshy fruits, and possibly some animal matter.

Reproduction and Development: Sometime between late April and mid-July, the female digs out a 6-inch deep nest in sandy soil, lays a clutch of 4 to 12 eggs, and after refilling the hole leaves the eggs for incubation by the sun's heat. Hatching occurs in August and September. The juvenile tortoises suffer a heavy natural predation loss of almost 97 percent through the first 2 years of life. Those that survive grow to sexual maturity slowly over a period of 13 to 21 years, depending on the portion of the range and the sex of the turtles. Males usually reach sexual maturity at a younger age and a smaller size than females. Females usually reach reproductive maturity at 19 to 21 years old. The low reproductive rate is accentuated by the fact that there is some evidence to indicate that not all females nest every year (Lohoefener and Lohmeier 1984; Wright 1982). The juveniles that are born and survive may live an average of 40 to 60 years, sometimes 80 to 100.

Most of the gopher tortoise's life is spent in and around the burrow. The gopher tortoise establishes a well-defined home range which increases in size as the tortoise grows older and larger. Gourley (1969) recorded a home range of 31,400 square meters (7.7 acres) for a 20.3-centimeter (8-inch) specimen. For refuge the tortoises dig burrows which average around 5 to 10 feet in depth and may be 10 to 20 feet (or

more) in length. The burrow becomes a more or less permanent home although there may be alternate burrows in the area. Several other species may also share gopher tortoise burrows. Some commonly known burrow associates include the eastern indigo snake, the eastern diamondback rattlesnake, and the gopher frog (U.S. Fish and Wildlife Service 1990).

Range and Population Level: The species occurs in sandy coastal plain areas from extreme southern South Carolina to the southeastern corner of Louisiana, and throughout most of Florida. The population segment from the Tombigbee and Mobile Rivers in Alabama, westward, is classified as threatened, and for convenience is termed the western population. This entire western population is within the original range of the longleaf pine. Using statistics of the U.S. Department of Agriculture (USDA) (1978a) the Fish and Wildlife Service estimates that present ownership distribution of gopher tortoise habitat is approximately two-tenths in National Forest, one-tenth in other public ownership, three-tenths in forest industry, and four tenths in other private ownership.

No estimate is available for the gopher tortoise's total population size. Auffenberg and Franz (1982) estimated a population density of 0.713 tortoises per hectare in Mississippi and 0.97 tortoises per hectare in Alabama in 1975, whereas Lohoefener and Lohmeier (1984) estimated a density of 0.107 and 0.32 per hectare in those states, respectively, in the early 1980's. Lohoefener and Lohmeier (1984) were also able to document only 11 active burrows in Louisiana in 1981, and only one remaining in 1984. Although these estimates may not be strictly comparable because of different methodologies, there is an indicated decline in population densities ranging from 67 percent in Alabama to 91 percent in Louisiana.

Habitat: The gopher tortoise most often lives on well-drained, sandy soils in transitional (forest and grassy) areas (Ernst and Barbour 1972). It is commonly associated with a pine overstory and an open understory with a grass and forb groundcover and sunny areas for nesting (Landers 1980).

Reasons for Current Status: Conversion of gopher tortoise habitat to urban areas, croplands, and pasturelands along with adverse forest management practices has reduced the western portion of the historic range of the gopher tortoise by more than 80 percent. Fragmentation of the western range accentuates those impacts. Taking gopher tortoises for sale or use as food or pets has also had a serious effect on some populations. The seriousness of the loss of adult tortoises is magnified by the length of time required for tortoises to reach maturity and their low reproductive rate. Current

estimates of human predation and road mortality alone are at levels that could offset any annual addition to the population. Sightings of gopher tortoises have become rare in many areas and the ones sighted are much smaller than in the past (Diemer 1984). A number of other species also prey upon gopher tortoises including the raccoon, who is the primary egg and hatchling predator; gray foxes; striped skunks; armadillos; dogs; snakes; and raptors. Imported fire ants also have been known to prey on hatchlings. Reported clutch and hatchling losses often approach 90 percent (Landers 1980).

Forestry management practices which allow development of thick underbrush, closing of forest canopies, or clearcutting, destroy food plants, inhibit nesting, and cause tortoises to relocate to the edge of roadsides and ditch banks, increasing their susceptibility to human predation and vehicle mortality.

Management and Protection: Less than 20 percent of the historically available habitat remains for the western population of the gopher tortoise. Protection of this habitat, along with proper management, deserves high priority. Since the gopher tortoise requires an open forest floor with grasses and forbs for food, and sunny areas, regular burning or thinning of trees is required to maintain this type of habitat. However, clearcutting and site preparation can be very damaging, with the adverse effects apparently persisting for many years (Wright 1982). Taking gopher tortoises for sale or use as food or pets has also had a serious effect on some populations, and will require control through public education and effective enforcement of taking prohibitions under Section 9 of the Endangered Species Act.

Artificial planting of longleaf has proven successful in the DeSoto National Forest and other areas. The U.S. Forest Service is continuing its practice of regenerating longleaf pine on longleaf pine sites in the Desoto Forest. However, most tortoise habitat is on private land and most timberland owners still have problems with the growth, economic value, and availability of seed stock of longleaf. Proper longleaf forest management for on-site species, such as the gopher tortoise, should be encouraged on private and state lands.

About 136,000 acres of gopher tortoise habitat in the DeSoto Forest has been used for military operations (Camp Shelby). A Section 7 consultation has resulted in the establishment of a 2,200 feet gopher tortoise refuge where military use is restricted and forest management benefits the tortoise.

Besides the activities discussed above, the recovery plan for the gopher tortoise, approved in December 1990, also suggests rangewide surveys at 5-year intervals on public and private lands; research on tortoise population viability and genetics; and rewards for conservation efforts on private land.

Summary: The gopher tortoise is found in xeric sandy habitats from South Carolina through Florida and west to extreme southeastern Louisiana. This species is listed as threatened in Louisiana, Mississippi and west of the Tombigbee and Mobile Rivers in Alabama, and is a candidate for listing in the rest of its range. The range of the gopher tortoise nearly coincides with the original range of longleaf pine. Suitable gopher tortoise habitat includes well-drained sandy soils, an abundance of herbaceous ground cover, and an open forest canopy with sparse shrub cover. Major causes of population declines include habitat loss, fragmentation, fire suppression, and predation including humans capturing them for food (U.S. Fish and Wildlife Service 1990).

Insects

American Burying Beetle (Nicrophorus americanus)

Status: Endangered (54 FR 29652; July 13, 1989). Critical habitat has not been designated.

Description: The American burying beetle is a large (1.5 inch; 4 cm) beetle with a shiny black appearance. Wing covers have four, relatively large, orange spots, and the pronotum is red. The beetle feeds on carrion. It was formerly known as the giant carrion beetle.

Life History: The American burying beetle reproduces by burying a small vertebrate carcass (1-9 ounces; 35-250 grams). An underground chamber is formed around the buried carcass, and eggs are laid in a side tunnel exiting the chamber. The larva then feed on the carcass. A positive relationship exists between brood size and carcass size. In the field, brood size has been found to range from 3 to 31. The American burying beetle is unusual among insects in that both parents provide care to their young. Care involves guarding as well as feeding the young. Adults sometimes have more than one brood in a season. American burying beetles are active on warm (above 60 F or 15 C) nights. Individuals are known to live only about a year.

Habitat: In Oklahoma, American burying beetles found in the Ouachita Mountains occur in oak-pine woodlands, open fields, and in the transition zone between the two. The other known Oklahoma population occurs on the western edge of the Ozark

uplift. These beetles are found in oak-hickory forests and open grasslands. Habitat requirements for the American burying beetle are not fully understood at this time.

Distribution: The historical distribution of the American burying beetle includes the eastern half of North America from southern Ontario, Canada, and the northern peninsula of Michigan to the southern Atlantic coastal plain. The western most known occurrence is a 1988 record from Dawes County, Nebraska. The current distribution includes Block Island, Rhode Island, as well as Bryan, Cherokee, Haskell, Latimer, LeFlore, Muskogee, Sequoyah, and Tulsa Counties in Oklahoma. About 100 American burying beetles have been reintroduced to Penikese Island, Massachusetts. Their status is currently being monitored.

Causes of Decline: The cause for the decline of this species is undetermined. It may be a result of habitat fragmentation, habitat loss, carcass limitation, pesticides, disease, light pollution, or a combination of these factors.

Recovery Needs: The highest priority recovery tasks include: (1) protecting and monitoring extant population, (2) maintaining captive populations, (3) continuing the Penikese Island reintroduction attempt, (4) conducting ecological studies, and (5) conducting field surveys for additional populations. The recovery plan was signed on September 27, 1991.

Other Information: Ongoing projects in Oklahoma include a study of the habitat preferences of the American burying beetle and surveys to locate additional populations. Other work includes a genetic comparison of the Oklahoma population with the Block Island population. The population size on Block Island is being estimated annually. Beetles originating from Block Island were used to establish captive populations at Boston University and the Cincinnati Zoo. A third captive population using beetles from Oklahoma is planned.

Summary: The American burying beetle historically occurred throughout temperate Eastern North America. Currently this species is only known to exist in Rhode Island, Arkansas, Oklahoma, and Nebraska. The Ouachita National Forest is the only forest with RCWs that also has known populations of American burying beetle. The broad geographic range of this species indicates there is no preference for a particular habitat type. Soils that are unsuitable for carcass burial (very xeric, saturated, or loose sandy soil) are probably avoided. Carrion availability appears to be more important than vegetation or soil type. The cause of the wide-spread population decline is unknown.

ENVIRONMENTAL BASELINE

Under section 7(a)(2), when considering the "effects of the action" on Federally listed species, the Service is required to take into consideration the environmental baseline. The environmental baseline includes past and present impacts of all Federal, State, or private actions and other activities in the action area (50 CFR 402.02), including Federal actions in the area that have already undergone section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in progress.

RCW Habitat Status

The current condition of RCW habitat within the action area is primarily a result of the many human related influences that have impacted the southeastern landscape since the beginnings of European settlement. Prior to 1600, longleaf forests and forests of longleaf pine mixed with other tree species covered about 94% (92 million acres) of the region's uplands (Frost, in press). The majority, if not all, of the action area acreage was included in this ecosystem. Today, this ecosystem has been reduced to 1-4 million acres. The conservative estimate, 1-2 million acres, is based on areas known to support more or less natural vegetation. The larger estimate includes second growth longleaf pine forests and plantations that are not representative of historical conditions (Kelly and Bechtold 1990).

The original reduction and loss of RCW habitat within the action area was caused by various factors. The primary causes were: (1) land clearing for agriculture/farm use, (2) extensive grazing by free-roaming feral livestock, (3) turpentining and the naval stores industry and, (4) massive timber harvesting prior to the establishment of the National Forests (Frost, in press). By 1920, most of the virgin forest was gone. Following the timber harvesting, forests were left understocked and overgrazed, both factors contributing to extensive regeneration failures. These factors were reinforced with aggressive fire suppression policies beginning about 1920. Since then, many acres of second growth forests, not adapted to the historical fire regime, replaced the original overstory vegetation, longleaf pine. Today, these forests are represented by older (40-50+ years) stands of "off-site" pines (usually slash and loblolly) and/or mixed pine-hardwood stands.

Since establishment (1907-1937) of the National Forests in the action area, several programs, including pine tree planting by the Civilian Conservation Corps, have helped to restore RCW habitat. However, other practices have not contributed to either short or long-term benefits to RCW

habitat. As an example, the aggressive fire suppression policies and lack of prescribed burning programs contributed to the development of pervasive hardwood midstories throughout many National Forests. Today, based on many years of documentation (Hopkins and Lynn 1971; Van Balen and Doerr 1978; Locke, et al. 1983; Hovis and Labisky 1985; Connor and Rudolph 1989), it is commonly accepted that RCW cluster abandonment can result from hardwood midstory encroachment. In small populations, and in combination with other habitat related and demographic factors, hardwood midstory development can result in cluster abandonment and population extirpations (Costa and Escano 1989).

Since the 1950's and through the 1980's, timber management programs within the action area contributed to both existing and potential nesting and foraging habitat loss and degradation. At the same time, many acres of second growth forest continued to mature, providing foraging habitat and with proper stewardship, potential nesting habitat. However, the Forest Service's traditional timber management program of the past 40 years within the action area, including: (1) reliance on clearcutting to regenerate stands, (2) perpetuating shorter rotations in many Forests; e.g., at least one-half of the 27 Forest Service HMAs have effective rotations for one or more pine forest types that are less than 80 years (based on percent of habitat in the 0-10 year age class), and (3) conversion of 10,000's of acres of second growth longleaf to off-site slash and loblolly plantations have all had adverse impacts on RCW nesting and foraging habitat. Additionally, some Forests within the action area had "clean" forestry programs whereby cavity, diseased, and defective trees were removed from forest stands. This practice not only removed existing RCW nesting habitat, but also limited availability of future nesting trees; cavity trees have not been removed since the RCW was listed.

Cavity tree shortages will continue to hinder RCW population growth. Many of the RCW cavity trees today are trees that were not harvested during the massive cutting early in the century. Today, these relicts or remnants are typically 120 to over 200 years old. These relicts, many of which on some Forests were turpentine trees, are today susceptible to windthrow, lightning, disease, or simply death from old age. Surrounding second-growth forests are typically 50-80 years old and supplying few potential cavity trees. In the absence of artificial cavities, it will be 10-40 years in many Forests before reliable numbers of potential RCW cavity trees are available.

Of the approximately 2,000,000 acres in the proposed tentative HMAs, 28% (0-30 year age class) is currently unavailable, and will remain so for at least 40-80 years

(depending on the species), as nesting habitat; the majority of these acres are also not considered suitable foraging habitat. Additionally, the fragmented landscape, created by 30+ years of clearcutting with shorter timber rotations and fragmented ownership patterns, restricts opportunities for RCWs to fully utilize the landscape. Connor and Rudolph (1991) have suggested that habitat fragmentation/loss between demographically isolated RCW groups may limit dispersal opportunities and access to foraging habitat; thereby, potentially increasing the probability of cluster abandonment and negatively affecting group size. Additionally, Rudolph and Connor (1994) hypothesized that fragmentation, at the levels examined, may interfere with efficient location of groups without females, by dispersing juvenile females.

Despite the Forest Service's efforts to comply with past RCW management direction (USDA 1979, USDA 1985), such efforts frequently fell short of full compliance and most RCW populations still declined. Populatiion declines were primarily caused by lack of potential cavity trees, lack of midstory control, and demographic isolation caused by continued loss of potential nesting and foraging habitat. The above situation, summarized by Costa and Escano (1989), in conjunction with the legal precedent set by the litigation in the National Forests in Texas lawsuit, lead to the development in 1990 of the Interim S&Gs. Details of this policy are available in USDA (1990), Escano (1990), and USDA (1991). Briefly, Interim S&Gs: (1) allows clearcutting only to reestablish longleaf pine, (2) requires retention of leave trees in regeneration harvests and establishes a 120 year rotation, (3) promotes thinning to reduce southern pine beetle (SPB) risk, create potential RCW clusters, and stimulate development of foraging habitat, (4) requires midstory control in all nesting habitat (active/inactive clusters, replacement, and recruitment stands), and (5) promotes installation of cavity restrictors and artificial cavities, and RCW translocations. Since implementation of Interim S&Gs, all active clusters have been treated for hardwood midstory control. However, many acres of nesting habitat stands (see # 4 above) and foraging habitat have not been treated. (EIS; Krusac, pers. comm.)

Since 1990, Interim S&Gs have protected RCW habitat within 3/4 mile of active and inactive clusters, but no specific measures were similarly implemented for habitat outside these zones. On Forests with relatively large and well distributed RCW populations, most future potential RCW habitat has been protected by Interim S&Gs. However, in some small to moderate sized populations (including some recovery units) habitat loss and degradation have continued in what, under the EIS, will be established as future RCW HMAs. For example, on the Bienville National Forest (a recovery unit,

with a tentative HMA of 125,160 acres) between 1990 and 1994, 8524 acres, of the approximately 70,000 acres outside 3/4 mile zones but within the tentative HMA, were regenerated; this equates to 12% of the area outside 3/4 mile circles. The 70,000 acres estimate was arrived at by multiplying 1130 acres (acreage within a 3/4 mile radius circle) by 195 (number of clusters in HMA), dividing the result (220,350 acres) by 4 (assumes a 75% overlap of all 3/4 mile circles, which should be a conservative estimate) and subtracting the answer (55,087 acres) from the total HMA acreage (125,160) to get 70,073 acres.

In summary, pre-1990 timber management related practices impacted both the quantity and quality of RCW nesting and foraging habitat in the action area. Since 1990, negative impacts have decreased in some populations but persisted in others. While much of the second growth forest continues to mature and gradually improves as RCW habitat, substantial acreage (565,588 acres of tentative HMAs) of the action area remains, and will so for many years, in non- to poor RCW habitat. RCW population expansion opportunities are limited at both the stand and landscape scales because of the current habitat conditions.

RCW Population Status

The RCW's historic decline within the action area was commensurate with the loss and degradation of the longleaf pine ecosystem previously discussed. The current status (size and trend) and distribution of the RCW in the action area varies by population and is a result of multiple, interrelated factors. These factors include: (1) historic land use impacts, (2) quantity and quality of nesting substrate remaining post-1920/30's logging, (3) non-Federal land ownership patterns (% and distribution of private lands) and past/present uses within Forest proclamation boundaries, (4) availability of refugia RCW populations within or adjacent to newly established (1907-1937) Forests, (5) local (ranger district or national forest) attitudes, policies, direction, and emphasis, over time (since the 1950's predominantly), regarding timber management programs, and (6) the degree that absence of fire continued to play a role in the growth and development of the second growth forest.

The first systematic survey of RCWs within the action area was conducted as part of a rangewide RCW survey done from 1980-1982 (Lennartz et al. 1983). In 17 National Forests, 10% of the compartments with suitable RCW habitat were 100 percent traversed to locate all RCW clusters; 4 Forests, harboring RCWs today, were not sampled for this survey. The Forest Service population estimate based on this survey was 2121, plus or minus, 405 active clusters; this was

approximately 70% of the active clusters found on all Federal lands during the 1980-1982 rangewide survey (Lennartz et al. 1983). Hamel (1980) examined and analyzed the Forest Service's Continuous Inventory of Stand Condition (CISC) data base and identified 2026 RCW clusters (status unknown) on Forest Service lands. More recently, Costa and Escano (1989) initiated a Regionwide survey to collect RCW information at the ranger district level. This survey, with a baseline of 1986, identified 2,115 active clusters in the action area. Annually, since the 1986 survey, the Forest Service updates the population size information for each Forest Service population unit. Based on these data, the RCW population in the action area in 1994 was 2,099 active clusters. This represents approximately 63% of the active clusters on Federal lands; and 45% of all active clusters known (Costa and Walker 1995). While during the past 10-20 years, most Forest Service populations were considered to be declining, several were known to be increasing. Because of problems associated with early (late 1970's-through 1980's) RCW surveys, pre-1988 regional trend data must be interpreted cautiously. Problems included: (1) mis-classification of cluster status (active/inactive), mis-identification of other wildlife sign as RCW cavities, (3) poor or inconsistent survey intensity, and (4) inconsistent survey methodologies.

Currently, 51 Federal RCW populations (ranging in size from 1 group to 500 groups) are known (unpubl. USFWS data); 27 (53%) are in the action area covered in the EIS. As previously discussed, the RCW recovery plan specifies that 15 recovery populations will be required to delist the species. Twelve (80%) of the 15 recovery populations are entirely (N=10) or in part (N=2; shared responsibility with Department of Defense lands) dependent on National Forest lands. The distribution of recovery populations, in relationship to states, physiographic provinces, and forest types is also a necessary component of delisting. Delisting requires that recovery units are established in 8 states, within 5 different physiographic provinces (broadly defined), and within the major southeastern forest pine types. The action area falls within 7 (88%) of the recovery states, 4 (80%) of the physiographic provinces, and includes all of the forest types considered necessary for recovery. Based on the above analyses, it is evident that the Forest Service has substantial and critical rangewide responsibility for RCW recovery.

Today, of the 12 Forest Service recovery populations; 1 is considered recovered (harbors 500 active clusters), 2 have 186 and 355 active clusters respectively, 3 have between 90 and 140 active clusters, 1 has 54 active clusters, and 5 have fewer than 50 active clusters. Of the 15 support populations, 1 has 66 active clusters, while the remaining 14

each harbor fewer than 50 active clusters. Based on data supplied to and interpreted by the Service covering the period from 1988-1993, 6 (22%) populations are increasing, 16 (59%) appear stable, and 5 (19%) are declining. Of the 12 recovery populations, 4 (33%) are increasing, 7 (58%) appear stable, and 1 (9%) is declining. While population trends appear to be improving since the early 1980's, the small sizes of the majority of the populations (18 [67%] of the 27 harbor <50 active clusters) continue to raise serious concerns about their long term stability and viability.

Significantly, it appears that the implementation of Interim S&Gs, and specifically the: (1) extensive hardwood midstory control program in active clusters, (2) installation of artificial cavities following established priorities, and (3) translocation efforts have been effective in halting most population declines. Biologically, the challenges remaining are to prevent extirpation of the very small (<15 active clusters; N=10 [37%]) populations, while attempting to grow those and other populations to self-sustaining levels within a relatively immature and fragmented landscape.

<u>Effects of the Action</u>

Introduction

Under section 7(a)(2), "effects of the action" refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action. Under section 7, the Federal agency is responsible for analyzing these effects. The effects of the proposed action are added to the environmental baseline to determine the future baseline which serves as the basis for the determinations in this Biological Opinion. Should these effects of the Federal action result in a situation that would jeopardize the continued existence of the species, the Service may propose reasonable and prudent alternatives that the Federal agency can take to avoid violation of section 7(a)(2).

The impacts discussed below are the result of direct and indirect effects of the proposed Forest Service action. Direct effects encompass the direct and immediate effect of the project on the species or its habitat. Indirect effects are caused by or result from the proposed action, occur later in time, and are reasonably certain to occur (50 CFR 402.02). The Service has determined that there are no interrelated or interdependent actions apart from the action under consideration.

Background

Alternative E (the proposed action) in the EIS discusses 11 major actions to be implemented within the action area. These include:

(1) Habitat Management Area Delineation
(2) Delineation of Tentative HMA Boundaries
(3) Setting Population Objectives
(4) Establishing Management Intensity Levels
(5) Establishment of Subhabitat Management Areas
(6) Protection of Clusters, Replacement, and Recruitment Stands
(7) Management of Clusters, Replacement, and Recruitment Stands
(8) Habitat Management Within HMAs
(9) Monitoring
(10) Southern Pine Beetle Hazard Reduction
(11) Clearing for Nontimber Management Purposes

Alternative E also provides information, analyses, and discussions on 3 significant issues that are further discussed and analyzed throughout applicable sections of the EIS. They are: (1) future nesting habitat, (2) regeneration and sustaining RCW habitat, and (3) habitat fragmentation control. Four (#'s 6, 7, 8, & 9) of the 11 major actions have additional activities (total of 27) associated with them. They are:

(6) Protection of Clusters, Replacement and Recruitment Stands

1. Cutting
2. Motorized, heavy equipment, and concentrated human use areas
3. Cavity tree protection during prescribed burning operations
4. Nesting season disturbance
5. Construction of rights-of-way
6. Existing rights-of-way reconstruction and maintenance
7. Southern pine beetle suppression

(7) Management of Clusters, Replacement, and Recruitment Stands

1. Marking cavity trees and cluster boundaries (monumentation)
2. Cluster status - data base management
3. Recruitment stands
4. Replacement stands
5. Midstory vegetation control
6. Artificial cavities

7. Cavity restrictors
8. Translocation

(8) Habitat Management Within HMAs

1. Prescribed burning
2. Pine restoration
3. Foraging habitat management
4. Establishing rotations
5. Thinning
6. Clearcutting
7. Seed-tree and shelterwood cutting
8. Irregular shelterwood cutting
9. Group selection cutting
10. Single tree selection cutting

(9) Monitoring

1. Population monitoring
2. Habitat monitoring

Because some of the actions are interrelated and/or associated with similar types of effects on nesting and/or foraging habitat, this biological opinion will, in the Summary and Discussion of the Effects of the Action section, combine related actions and evaluate total effects (mostly indirect) within the context of the 3 issues listed above and in reference to expected future: (1) landscape conditions, and (2) RCW population response. For instance, everything else being equal, e.g. midstory controlled, availability of future nesting habitat is primarily a function of items (4), (7)3.& 4., and (8)4.,6.,7.,8.,9.& 10. Parameters considered during analyses for effects of actions include, distribution, timing, duration, and disturbance frequency, intensity and severity.

(1) Habitat Management Area Delineation

Direct effects - none

Indirect effects

Establishing HMAs will provide indirect positive effects on RCW populations. Managing large (6,500 to 150,000 acres), contiguous areas of nesting and foraging habitat will ensure that the landscape attributes important for healthy RCW populations will be created and maintained. In addition to population size, the distribution and density of intra-population RCW groups is important to population viability (Walters 1990, Walters et al. 1988a). Landscape scale management will help ensure that factors potentially disruptive to group/population stability and viability, such

as fragmentation (Connor and Rudolph 1991a; Rudolph and Connor 1994), will be minimized. HMAs will increase intra-population dispersal opportunities for RCWs, thereby reducing adverse effects on the population caused by demographic isolation of groups (individual groups or subpopulations). Managing relatively large RCW populations within a landscape context may reduce/minimize the impacts of adverse effects associated with environmental stochasticity and small populations (Gilpin and Soule 1986).

(2) Delineation of Tentative HMA Boundaries

Direct effects - none

Indirect effects

See **(1)** (**Habitat Management Area Delineation**) for indirect effects. To protect habitat during the transitional period between the start of new Regional direction and subsequent Forest Plan amendments and revisions, only the following silvicultural systems and practices will be allowed: (1) thinning, (2) irregular shelterwood method (two-aged) leaving a minimum of 40 square feet of basal area, (3) single -tree and group selection methods (uneven-aged), and (4) clearcutting (even-aged to restore longleaf or other desirable pine species on appropriate sites. Indirect effects of restoration efforts within tentative HMAs are possible. However, these will be minimized by requiring the Forests to first identify sufficient recruitment stands and foraging habitat to meet their tentative population objective identified in the EIS before beginning restoration projects.

Based on information available in the EIS, delineation of tentative HMA boundaries will establish 1,962,183 acres to be managed as RCW habitat.

(3) Setting Population Objectives

Direct effects - none

Indirect effects

Setting population objectives will indirectly affect RCWs by triggering a series of actions necessary to achieve those objectives. The effects of those actions are discussed throughout the "Effects of the Action" section of this biological opinion. Over the long-term, meeting the population objectives within the action area will, to a large degree, ensure the recovery of the species by establishing 80% of the required recovery units. During the short-term, population objectives provide a measurable benchmark to evaluate the progress toward recovery. If populations are

not increasing toward stated objectives, in spite of full-implementation of the management actions discussed in the EIS, it will be necessary to reevaluate the effects of management actions on RCWs.

(4) Establishing Management Intensity Levels

Direct effects - none

Indirect effects

Establishing MILs will indirectly affect RCWs by requiring different levels of habitat protection, e.g., constraints on regeneration for different size populations. The higher the risk of extirpation, evaluated based on population size and trend, the greater the level of habitat protection. The effects of these constraints, including regeneration methods, leave tree requirements, and regeneration stand size limits (fragmentation), are discussed throughout the "Effects of the Action" section of this biological opinion (see, in particular, **(8)** (**Habitat Management Within HMAs**).

MIL designation (MILs 2, 3, and 4) should have positive affects on small and/or larger but declining RCW populations by: (1) minimizing/eliminating the potential adverse effects of landscape fragmentation (Connor and Rudolph 1991a), (2) providing potential cavity trees with all silvicultural options (Jackson 1982; Connor and O'Halloran 1987; Connor et al. 1991), and (3) maximizing opportunities for dispersal and subsequent establishment of new breeding pairs. The criteria established for a population to move from one MIL to another, in either direction, will ensure that populations are not adversely affected by reductions in management and protection intensities because of minor or short-term (annual) population fluctuations. Based on the best current information available (unpubl. USFS data) regarding the size and trend of the only recovered population, the Apalachicola Ranger District, the constraints associated with MIL 1 should be sufficient to maintain, and indeed increase, recovered populations [see **(8) 4.** (**Establishing rotations**) for details].

(5) Establishment of Subhabitat Management Areas

Direct effects - none

Indirect effects

The positive affects of subhabitat management areas (sub-HMAs) for populations in MIL 4 will be similar to those described above in **(1)** (**Habitat Management Area Delineation**). The habitat outside sub-HMAs, but within the designated HMA

for the population, will be managed at MIL 2. Managing currently unoccupied, but designated future, RCW habitat under MIL 2 should not adversely affect the existing population or its ability to expand into the remainder of the HMA. However, implementation of the sub-HMA management concept, while not adversely affecting RCWs, will probably have limited, if any, positive biological or habitat related value for the existing or future population when compared to the alternative habitat protection/management strategies specified in MILs 3 and 4. For example, while MIL 2 does provide for retention of residual trees in regeneration areas, fewer are required; additionally, larger regeneration units are permitted.

(6) Protection of Clusters, Replacement, and Recruitment Stands

1. Cutting

Direct effects

Cutting of active cavity trees, which pose a public safety hazard or harbor damaging insects (therefore, potentially contributing to loss of additional cavity trees), could result in destruction of eggs and/or nestlings during the breeding season, and loss of adult/juvenile roosting sites. Open-roosting RCWs are vulnerable to injury and death from exposure and predation.

Indirect effects

Cutting could indirectly, adversely affect RCWs if, for example, the tree being felled or the equipment being used to cut the tree damaged a cavity tree; however, these impacts are not likely to occur. Because cutting trees in designated nesting habitat will only occur if that action would benefit RCWs, i.e., protect or improve habitat, no other adverse effects of cutting are expected. Foraging habitat loss in the vast majority of cases will be negligible.

Beneficial effects include, reducing and/or eliminating cavity tree losses from insects and disease, and improving nesting habitat quality, removing midstory for example.

2. Motorized, heavy equipment, and concentrated human use areas

Direct effects - none

Indirect effects

Motorized and heavy equipment use in designated nesting

habitat could damage cavity and potential cavity trees. Concentrated human use in active clusters could result in reduced reproductive success or potentially, cluster abandonment. However, the restrictions on this action, required by the EIS, will minimize or eliminate adverse effects.

3. Cavity tree protection during prescribed burning operations

Direct effects - none

Indirect effects

The primary positive effect of protecting cavity trees during burning operations is that doing so will minimize the risk of damaging and/or killing cavity trees. Negative effects are possible if cavity tree protection measures result in cavity tree injury; e.g., root damage caused by removing fuels or construction of plow lines, or tree damage caused by back burning from the base of the cavity tree. The constraints specified in the EIS regarding acceptable cavity tree protection standards and the use of fire in nesting habitat will minimize or eliminate adverse effects.

4. Nesting season disturbance

Direct effects - none

Indirect effect

Frequent and long-term (several hours) disturbance during the nesting/incubating/brooding seasons or disrupting feeding schedules during nestling tending may result in nest failures or nestling deaths. However, the restrictions on this action, required by the EIS, will minimize or eliminate adverse effects.

5. Construction of rights-of-way

Direct effects - none

Indirect effects - none

6. Existing rights-of-way reconstruction and maintenance

Direct effects - none

Indirect effects

Potential adverse effects of reconstruction and maintenance include damage to potential and existing cavity trees, and

disturbance of nesting activities resulting in effects similar to those discussed above in **#4. Nesting season disturbance**. However, the restrictions on this action, required by the EIS, will minimize or eliminate adverse effects.

7. Southern pine beetle suppression

Direct effects - none

Indirect effects

Southern pine beetle suppression and/or hazard reduction activities involve cutting infested and uninfested trees in clusters, including, in some cases, active and inactive cavity trees. Some of the effects (beneficial and adverse) of this action are similar to those discussed in **(6) 1. cutting** and **(8) 5. thinning**. Additional adverse effects include loss of active, inactive, and potential cavity trees. The loss of active cavities could result in the temporary loss of roost sites and increase potential mortality risks for birds open-roosting.

Several years ago wilderness RCW groups were considered to be essential to RCW recovery (Southern Pine Beetle Biological Opinion and FEIS, 1986 and 1987). However, advances and success in artificial cavity provisioning and RCW translocations have decreased the importance of the few remaining wilderness RCW groups to a point where they are no longer considered "essential" to recovery from a southern pine beetle suppression perspective. New management strategies have reduced the importance of individual wilderness clusters, and permitted management to focus on habitats where recovery can most likely be accomplished; no wilderness RCW groups are required for recovery. Because alternative/additional RCW nesting sites can be provided, to either replace or compensate for those destroyed by southern pine beetles in wilderness areas, it is no longer necessary to consider wilderness RCW groups "essential".

The significant beneficial effect of SPB suppression in nesting habitat is that cavity trees are protected from infestation and thus saved as roost and nest sites.

(7) Management of Clusters, Replacement, and Recruitment Stands

1. Marking cavity trees and cluster boundaries (monumentation)

Direct effects - none

Indirect effects

Identifying cavity trees (permanently) and cluster boundaries (normally temporarily) will help ensure that potential adverse impacts to cavity trees or nesting habitat from resource management activities in or adjacent to clusters, replacement, or recruitment stands will be avoided or minimized.

2. Cluster status - data base management

Direct effects - none

Indirect effects - none

3. Recruitment stands

Direct effects - none

Indirect effects

Establishing recruitment stands in MILs 2, 3, and 4 will have no adverse affects on RCWs. These stands will benefit RCWs, during the next 10-40 years, when properly managed (i.e., midstory controlled) and provisioned with artificial cavities. Although probable and documented occurrences of budding and pioneering have been noted (Hooper 1983; Hooper et al. 1991a; unpubl. USFS data) population expansion during the next several decades cannot be expected to occur quickly without artificial cavities, given the current forest age class structure in the majority of the action area.

Recruitment stands, carefully selected (both for their attributes and location within the recovery or support unit), prepared (i.e., provisioned with artificial cavities), and maintained as quality nesting habitat will result in RCW population increases (Gaines et al., in press; Richardson and Stockie, in press). The rate at which populations expand will be a function of their size, distribution, variability, reproductive rate, and resilience to disturbance. Existing and expected future landscape conditions (suitability and availability of nesting and foraging habitat) will also influence population expansion potential.

4. Replacement stands

Direct effects - none

Indirect effects

Establishing replacement stands for all active clusters in all MILs will have no adverse affects on RCWs. Although

unproven as a management tool, identifying, preparing, and maintaining replacement stands should benefit RCWs over the long-term. As a minimum they provide a potential future source of cavity trees for existing groups. In the event of the unexpected loss (fire, wind, etc.) of existing active cavity trees, established replacement stands could be immediately provisioned with artificial cavities, potentially providing secure roosting sites for temporarily open-roosting RCWs.

5. Midstory vegetation control

Direct effects - none

Indirect effects

Hardwood midstory encroachment in RCW clusters results in abandonment of cavity trees and clusters (Hopkins and Lynn 1971; Van Balen and Doerr 1978; Locke et al. 1983; Hovis and Labisky 1985; Connor and Rudloph 1989); and has, in conjunction with other deleterious factors, i.e., demographic isolation, contributed to population extirpations within the action area (Costa and Escano 1989). Midstory vegetation may also reduce available foraging substrate for female RCWs which prefer to forage on the trunks of pine trees. Although not definitively quantified to date, some biologists believe that midstory vegetation may increase both the numbers of RCW cavity competitors in the area and the potential for RCW predation (Jackson 1978a). Loeb (1993) suggests that only removing midstory around cavity trees is not sufficient to keep flying squirrels from RCW cavities. Heiterer (1994), found that flying squirrel use, abundance, and survival was higher in pine stands with hardwood midstory than in stands without. Wilson et al. (1995) examining bird community response to hardwood midstory removal in RCW habitat, found that pileated woodpeckers occurred most frequently in control stands, i.e., those containing midstory.

Removing hardwood midstory vegetation in nesting habitat will benefit RCWs by minimizing the adverse effects discussed above. Controlling midstory vegetation throughout the general forest area will potentially improve foraging habitat conditions for RCWs. Additionally, if other factors are suitable, i.e., older trees available for cavity excavation, midstory removal will provide opportunities for population expansion by increasing the suitable acres of potential nesting habitat. Connor and Rudolph (1991b) found no adverse effects of midstory removal on RCWs.

Provided constraints (timing, equipment use, etc.) specified in the EIS regarding midstory vegetation control are followed, this action will have beneficial effects on both

individual RCW groups and RCW populations.

6. Artificial cavities

Direct effects

Installing artificial cavities does have the potential to kill RCWs. Improperly constructed and/or installed, both drilled cavities (Copeyon 1990; Taylor and Hooper 1991) and artificial cavity inserts (Allen 1991) can leak resin and thus have the potential to trap and kill RCWs. Both nestling and adult RCWs have been trapped in, and subsequently died from, resin that leaked into both types of artificial cavities. Post-installation monitoring will minimize this threat.

Indirect effects

Artificial cavities can benefit RCWs by: (1) replacing cavities lost to catastrophic events, i.e., hurricanes (Watson et al., in press), (2) replacing cavities lost to SPB control activities, fire damage, or similar one-time, relatively minor impacts, (3) providing additional cavities in clusters where they may be limiting; potentially decreasing individual RCW exposure to predation and reducing competition with cavity competitors, and (4) providing opportunities for population expansion in Forests where suitable potential cavity trees are limiting and/or populations are so small that extirpation is a threat (the situation in the majority of the action area).

To date, with few exceptions, and with everything else being equal (i.e., midstory controlled, no chronic disturbance or condition "permanently" suppressing the population, etc.), wherever artificial cavities have been used, particularly in conjunction with translocation, but not necessarily, RCW populations have been stabilized and most are increasing (Hooper et al. 1990; Connor et al. 1995; Gaines et al., in press; Reinman, in press; Richardson and Stockie, in press; Ferral, pers. comm.; and Walters pers. comm.).

The priorities established in the EIS for using artificial cavities will benefit RCWs by first helping to stabilize existing groups where necessary, by ensuring most group members have a useable cavity. If this has the effect of maintaining or increasing group size, higher numbers of fledglings may be expected (Lennartz et al. 1987; Walters 1990; Beyer et al., in review). Additional, or more useable cavities per cluster may also increase the fledgling-to-helper transition rate, thereby increasing group size. By providing roosting sites for fledglings/sub-adults, particularly females, artificial cavities also increase

potential opportunities to trap donor birds for translocation.

Artificial cavities will be one of the cornerstones of RCW recovery efforts in the action area for the next 10-40 years. Their effects on individual RCW groups and populations have been tested, and proven overwhelmingly effective and beneficial, at this time.

7. Cavity restrictors

Direct effects

Improperly installed or adjusted cavity restrictors have the potential to injure RCWs (Carter et al. 1989). A restrictor has been responsible for the death of an RCW.

Indirect effects

Cavity restrictors can have indirect beneficial effects on RCWs by reducing usurpation and/or enlargement of RCW cavities by competitors and rehabilitating cavities with enlarged entrances (Carter et al. 1989). They will provide little or no direct benefit to RCWs when installed on cavities that have been internally enlarged to the point of being unusable by RCWs. Indeed, installing them on unusable cavities (by RCWs) could increase competition for suitable RCW cavities be limiting the availability of other cavities for competitors.

If not properly adjusted, cavity restrictors can prevent RCWs from entering their cavity. This negative effect is easily remedied by close monitoring after installation and immediate removal and reinstallation until proper fit is achieved.

Overall, cavity restrictors, properly installed will have a positive affect on RCWs.

8. Translocation

Direct effects

Translocating RCWs involves considerable handling of birds from the day they are banded as nestlings to the day they are placed in a cavity tree at the recipient population. Direct effects of this action include injury and death to nestlings and adults. Destruction of eggs is also possible during nest monitoring activities. Nestlings are vulnerable while being: (1) removed from, and placed back into, the nest cavity, (2) transported to the ground and back up the tree, (3) handled and banded during the banding process. Adults are vulnerable while being: (1) trapped in, and removed from, capture nets,

(2) placed and transported in, and removed from, transport boxes, (3) carried up their "new" cavity tree and placed in the cavity, (4) released from the cavity, and (5) handled and banded during the banding process, which is not typical of adult birds slated for translocation, as most are banded as nestlings.

Indirect effects

The removal of RCWs from a population can potentially adversely affect that population. Removing juvenile females, the most common translocation made, reduces the pool of potential female breeders (and helpers in some populations, see Walters 1990; Delotelle and Epting 1992) for the next reproductive cycle. Removing juvenile males reduces the pool of potential breeders and helpers for the next reproductive cycle. Fewer or no helpers could result in reduced fledgling production in the groups where juvenile birds were removed. Removing any RCWs can slightly alter the demographic composition of a population. Removal of juvenile birds from larger populations will have little, if any, affect on the genetic composition of the population; e.g., the removal of any "novel" genetic material (Stevens pers. comm.).

The basic underlying assumption with translocation is that only "surplus" birds are being removed; i.e., those within the percentage expected to suffer mortality or disperse from their natal population. Adverse effects will be minimized by following recently established translocation standards. These standards include: (1) controlling which recovery units can contribute birds (minimum size and stable or increasing population trend required), (2) limits on the number of birds (sex and age class) that can be removed, (3) careful selection of donor clusters (i.e., cluster density/unit area considerations), (4) limits on removal of juvenile males based on existing group composition (i.e., number of helpers present), (5) knowledge of single male groups in the vicinity of donor clusters, if juvenile females are being considered for removal, and (6) demographic considerations, including turnover rate of breeding females, and the populations past reproductive performance.

Indirect effects of successful translocations on the recipient population will be positive. All recipient recovery or support units harbor small RCW populations in danger of extirpation. Several populations existing today have probably, at least to this point, been saved from extirpation because of translocated RCWs. Successful translocations result in increased numbers of breeding pairs; which in turn can increase the populations reproductive effort and ultimately its size and viability. Although deleterious genetic effects, such as inbreeding depression,

may occur in small populations as they increase, the fact remains that new birds will not only increase the population's genetic variability, but also help solve the demographic problems that can result in population extirpation if new birds are not introduced. Long-term effects of these genetic affects are not understood at this time. However, most biologists studying RCW population viability and genetics recommend that relocations must continue because of the overwhelming demographic problems in small populations (Haig pers. comm.; Stevens pers. comm.).

There also are potential adverse indirect affects on those birds translocated to, but unsuccessfully pair bonding at, the recipient population. The post-translocation history of these birds is not well understood. A small percentage of donor birds that do not remain at their intended release site are found established at another cluster (Costa and Kennedy 1995). Some, particularly those moved 20 miles or less (intra-population) return to their natal cluster. However, most are never seen again. Presumably, a majority of them suffer mortality due to any number of factors associated with being released in unfamiliar territory, including exposure and predation.

Costa and Kennedy (1995) have recently summarized the results of most (n=143) RCW translocations within the action area from 1989-1994. Their findings indicate that translocations are having beneficial effects in recipient populations by establishing new, reproductively (fledging young) successful breeding groups. Translocations planned, implemented, and monitored, as required by Service guidelines and permits, and as outlined in the EIS, will benefit the recovery program and hence the species as a whole, while minimizing the adverse impacts to the donor populations.

(8) Habitat Management Within HMAs

1. Prescribed burning

Direct effects

Growing season prescribed burning does have the potential to destroy RCW eggs, nestlings and/or adults. However, Stamps et al. (1983) concluded that burning during the nesting season apparently did not affect nestling survival. Similarly, a recent study conducted by The Nature Conservancy of Georgia (undated/1994) on Fort Benning Army Installation found no adverse effects of burning during the growing season in 10 treatment sites (clusters), which included 2 nests with eggs and 6 cavities with nestlings.

Indirect effects

Although RCWs will use dead cavity trees to roost and nest in (Hooper 1982; R. Costa pers. obs.), prescribed burning can indirectly affect RCWs by killing and/or injuring cavity trees, either making them immediately, or eventually rendering them, unsuitable for RCWs. Prescribed burning can also destroy, usually by enlarging, RCW active cavities without killing the cavity tree. Once enlarged, such cavities are generally not used by RCWs; the resident bird may be more vulnerable to exposure and predation if it must roost outside as it constructs a new cavity.

Prescribed burning, especially conducted during the growing season, has a positive affect on RCWs by eliminating and controlling hardwood midstory. Because the RCW evolved in, and is now dependent upon, a fire maintained ecosystem, the long-term benefits of properly applied prescribed fire cannot be overstated. Fire is the most important factor in the natural establishment, growth and development of the southern pines (longleaf in particular); the nesting and foraging substrate that the RCW must have to survive. In general, the average 4-year burning frequency discussed in the EIS should be sufficient to maintain the landscape attributes, particularly the open, park-like characteristic, needed for RCWs to thrive. In the short-term, a shorter fire frequency (1-2 years) may be required to eliminate established hardwood midstories. Longer fire frequencies (4-5 years) in some forests, east Texas loblolly for example, may be insufficient to control hardwood midstory development. Additionally, higher fuel loads may increase the intensity and/or severity of the disturbance to unacceptable levels, resulting in stand damage and subsequently, direct (tree death) or indirect loss (SPB infestation) of foraging habitat.

Prescribed burning, applied as stated in the EIS, and with cavity tree protection measures as required, will have beneficial affects on RCWs by improving and sustaining suitable nesting and foraging habitat throughout the action area.

2. Pine restoration

Direct effects - none

Indirect effects

Most pine restoration will require clearcutting; therefore the effects of this action will be similar to those discussed for clearcutting, particularly in the older stands scheduled for restoration. These older, usually loblolly or slash pine stands, are typically between 40 and 60 years old. They

became established following initial cutting of the longleaf/shortleaf forest and in the absence of fire, which would have favored the reestablishment of longleaf or shortleaf. Today, these stands may be providing RCW foraging and in some cases nesting habitat. Because off-site nesting habitat will not be regenerated until the stands are no longer suitable as nesting habitat there will be no adverse effects from restoration of these sites. Constraints on age class distributions, requirements for foraging habitat minimums, and retention of trees of the species being restored if present in the stands, will minimize adverse effects regarding fragmentation and foraging habitat when restoring these older off-site stands.

Restoration of younger off-site stands, usually <30 years old, should have little adverse affects on RCW habitat. Today, these stands are not considered, and probably typically do not provide, quality foraging habitat. Additionally, because they are in the 0-30 year age class and in many cases not growing well they are currently, and may continue, contributing to fragmentation. Restoring these sites back to longleaf will benefit RCWs over the long-term by providing higher quality, more desirable nesting and foraging habitat. Constraints on age class distributions, controlled by rotation ages, will minimize potential fragmentation problems in the later years (30-50 years from now) of the restoration program.

3. Foraging habitat management

Direct effects - none

Indirect effects

In general, providing foraging habitat at the recommended Service levels (Henry 1989) will have a positive affect on RCW populations. Availability and quantity of foraging habitat may affect group size (Connor and Rudolph 1991a). Foraging habitat quantity has also been correlated to group performance, i.e., number of young fledged (U.S. Fish and Wildlife Service 1985). Conversely, other studies (Wood et al. 1985; Delotelle and Epting 1992; Beyer et al., in review; Hooper and Lennartz, in press) have suggested that foraging habitat availability (considerably below Service guidelines in some cases) is not a primary factor controlling fledgling success.

There are situations when following the requirement to provide foraging habitat at the recommended levels may indirectly adversely affect RCWs, over the short-term, by conflicting with other management activities deemed necessary to benefit the RCW over the long-term. Beyer et al. (in review) elaborate on these situations; they include, thinning to restore native plant communities, reduce SPB risk, encourage establishment of advanced regeneration, and improve quality of foraging habitat (e.g., reducing BA/acre from 120 to 90), and restoration of off-site species to longleaf pine. Potential adverse affects on RCWs, caused by going too far below the foraging habitat standards when implementing actions to address one of the situations discussed above, will be avoided by adhering to foraging habitat minimum guidelines established in the EIS.

4. Establishing rotations

Direct effects - none

Indirect effects

Indirectly, rotations may affect RCWs by influencing the: (1) quality, availability, number, and distribution of potential cavity trees, (2) quantity, quality, and distribution of foraging habitat, (3) degree of landscape fragmentation, which in turn may influence dispersal opportunities, exposure to predation, etc., and (4) potential population density per unit area.

Based on the vast majority of published literature and unpublished, but compiled and analyzed, cavity tree age data from across the action area, the rotations specified in the EIS (120-longleaf and shortleaf, 100-loblolly and slash, 70-Virginia, and 80-loblolly and shortleaf/SPB), in combination with other MIL requirements, should be adequate to supply sufficient quantities of high quality RCW cavity trees. The table below summarizes a sample of the published and unpublished data relative to cavity tree ages for longleaf pine.

Table 4: RCW Cavity Tree Ages for Longleaf Pine

Study Site or State	Mean Age of Cavity Trees or %<120 yrs	Sample Size	Source and or Yr. of Data
NC & FL	104 yrs	54	DeLotelle & Epting 1988
Apalachicola NF	84% <120	43	FS 1974/75
Apalachicola NF	88% <120	26	FS 1989/90
Francis Marion NF	62% <120	92	FS 1986
Francis Marion NF	95 yrs	34	Jackson et al. 1979
Francis Marion NF	105 yrs	55	Hooper et al. 1991b
NFs in Texas	126 yrs	123	Connor & O'Halloran 1987
NFs in Texas	131 yrs	149	Rudolph & Connor 1991
Ocala NF	84% <120	35	Hooper 1988
Osceola NF	87% <120	40	Hooper 1988
Apalachicola NF	104 yrs	203	Hovis & Labisky 1985
Georgia	103 yrs	26	Jones & Ott, 1973
NFs in Texas & Fairchild SF	136 yrs	22	Lay & Swepston 1973
Southern FL (State & Federal lands)	103 yrs	105	Shapiro 1983

Data available for loblolly and shortleaf pine cavity tree ages show a relationship similar to the above, in that mean cavity tree ages are below or close to the rotations specified in the EIS (for some representative studies see the following; Jones and Ott 1973; Jackson, et al. 1979; Connor and O'Halloran 1987; Hooper, et al. 1991b; and Rudolph and Connor 1991).

The effect of a 120 year rotation on availability of potential cavity trees (longleaf >100 years old; see Clark 1992b) in MIL 1, using even-aged management with no retention of residuals, equates to approximately 11,040 trees/1000 acres. This figure assumes that of the 1000 acres, 80 acres (4 clusters and 4 replacement stands @ 10 acres minimum each) will be "very old" (i.e. 20" DBH @ 50 BA/acre = 23 trees/acre or 1840 trees) and 230 acres (3/12ths of 920 acres, i.e. the 100, 110 and 120 year old age classes @ 76.6 acres each) will supply 9200 trees over 100 years old (18" DBH @ 70 BA/acre = 40 trees/acre). While site differences and other factors may influence these numbers to some degree, it is clear that this management strategy will supply an adequate number of potential cavity trees for the 4 RCW groups expected per 1000

acres in recovered populations, i.e. MIL 1.

Similar examples can de developed for other MILs. Significantly however, in MILs 2, 3, and 4, additional potential cavity trees will be available because of the requirements to retain residual trees (numbers vary by MIL) in regeneration areas. In high risk SPB and littleleaf areas an 80-year rotation option is available. The potential adverse effects (e.g., limited availability of cavity trees and increases in fragmentation) of regenerating stands earlier with this option will be minimized or eliminated by the requirement (including in MILs 1 and 2) to permanently retain 25-30 square feet of pine BA/acre, but not less than 10 trees/acre. Residuals must be dispersed over the regeneration area.

In MIL 1, using a 1000-acre longleaf pine forest example with even-aged management and no retention of residuals, and assuming 4 RCW groups/1000 acres, approximately 7.6% and 23% of the area would be in the 0-10 and 0-30 year age classes, respectively. The effect of this level of fragmentation on a recovered RCW population is, at this time, not fully understood. However, current knowledge regarding the relationship between the status and trend of the Apalachicola RD RCW population, the only recovered population, and the existing habitat (landscape) conditions in that recovery unit, particularly those created by timber harvesting during the previous 30 years, offer some valuable insights.

Currently, on the Apalachicola RD, 15% and 38% of the longleaf forest habitat (includes off-site slash to be restored to longleaf) is in the 0-10 and 0-30 year old age class, respectively. Based on the 0-10 and 0-30 age class percentages, the effective rotation on the District is 66 and 79 years, respectively, well below the 120 years in MIL 1. Within the 141,263 acre tentative HMA on the Apalachicola RD, 50,495 acres of longleaf, slash, loblolly, and pond pine stands are less than 30 years old; this acreage includes 989 stands that average 51 acres in size. By any standard and accepted measures of landscape fragmentation, the current conditions on the Apalachicola RD can be "classified" as fragmented.

In 1994 the Apalachicola RD RCW population was 500 active clusters; during the 6-year between 1988 and 1993 it fluctuated between 482 and 504 active clusters. From 1990 to 1994, based on a 20% sample (minimum), over 250 groups (1990-327, 1991-297, 1992-377, 1993-359, & 1994-349) have annually fledged young, satisfying the basic requirement to classify a RCW population recovered. Between 1989 and 1991, the 41 compartments that were systematically searched for RCW clusters in 1980-1981, as part of the rangewide RCW survey

previously discussed (Lennartz et al. 1983), were resurveyed. The results of the 10-year trend analysis indicate that this population increased approximately 10% between 1980 and 1990 (Costa et al., in prep.; unpubl. USFS data;). The information provided in this and the previous paragraph, suggests that the level of fragmentation that will be created by the EIS rotations will not adversely affect recovered RCW populations. Similar levels of fragmentation and population response have been measured for the recovered (pre-Hugo) Francis Marion National Forest recovery unit (Hooper and Lennartz, in press).

From a distributional perspective, with everything else being equal, i.e., management area size, patch (harvest unit) size, distribution of harvest units across the area, etc., the shorter the rotation the poorer the distribution of both nesting and foraging habitat. This is because shorter rotations require more cutting units per unit area.

Nesting and foraging substrate quality can also be affected by tree age. Older trees, provided by longer rotations, have several characteristics that favor them as candidates for cavity trees and foraging substrate. Details of these characteristics are discussed by Jackson and Schardien-Jackson (1986). Given the RCWs preferential selection of older trees as cavity trees (DeLotelle and Epting 1988; Rudolph and Connor 1991) and larger trees (i.e., usually older) as foraging substrate (Hooper and Lennartz 1981; DeLotelle, et al. 1983), it is evident that RCW recovery (i.e., growing many small populations to recovered levels) should not be dependent upon rotations shorter than those specified in the EIS.

Although not yet well established in RCW literature (but see Jackson and Schardien-Jackson 1986), it is plausible, given what is known about the birds life history and ecological requirements, to believe that another positive effect of older forests is that they can support more RCW groups per unit area. For this territorial, cooperative breeding species, higher population densities may help maintain low population variability (fluctuation in population numbers over time) and minimize the adverse effects of frequent, intense, or severe disturbances, i.e. hurricanes; (see Hooper and McAdie, in press, for potential impacts of hurricanes on RCW recovery populations).

5. Thinning

Direct effects - none

Indirect effects

Thinning 10+" DBH stems in RCW territories will reduce the availability of potential foraging substrate. Conversely, thinning trees from stands old enough (generally 30+ years; see Henry 1989) to provide foraging habitat will maintain and increase the growth, health and vigor of the residual trees and potentially make them more desirable as foraging substrate. Thinning can indirectly benefit RCWs by reducing the risk of SPB infestation and subsequent loss of foraging habitat. Thinning in stands not generally considered foraging habitat (<30 years old; see Henry 1989) can decrease the time required for residual trees in the young stand to reach the desired 10" DBH foraging standard. Thinning in very densely stocked, older stands may immediately improve their suitability as foraging habitat, given the RCWs apparent preference to use open, park-like stands.

Following the leave tree priorities for MILs 2, 3, and 4 in the EIS thinning guidelines for mature stands will positively affect RCWs by retaining existing relics, and providing future potential cavity trees throughout the general forest area as soon as possible.

6. Clearcutting

Direct effects - none

Indirect effects

Clearcutting may indirectly affect RCWs in a number of ways. Clearcuts eliminate potential nesting habitat for many years (60-100+, depending on tree species and site) and foraging habitat for at least 25-30 years on most sites. Habitat loss associated with clearcutting may have an adverse affect on group size in small populations because of dispersal and/or demographic problems (Connor and Rudolph 1991a). Predation pressure on, and subsequent losses of, RCWs may increase for groups nesting adjacent to, or frequently flying over, clearcuts. Clearcutting may benefit RCWs, over the long term, when used to remove off-site species (usually slash or loblolly pine) and reestablish desirable species, i.e., longleaf pine. Hooper and McAdie (in press) have suggested that a balance of age classes, which can be provided via clearcutting, may be beneficial in RCW populations subject to reoccurring hurricanes, i.e., coastal plain recovery units. Younger (<30 years for example), even-aged stands may survive the storm's destructive forces, thereby providing some foraging habitat immediately, or relatively soon (depending on stand age), after the event. However, Connor and Rudolph (in press) suggest that, depending on the configuration of clearcuts and their spatial relationship to clusters/cavity

trees, harvest units may funnel wind into clusters and cause damage to cavity trees.

Clearcutting, used as discussed in the EIS (MILs 1, 2, 3, & 4 and primarily for reestablishment of longleaf and shortleaf pine) and within the various required constraints (rotation ages, stand size restrictions, cluster isolation and foraging habitat controls, retention of reserve trees when present, etc.) should have no adverse affects on RCWs and indeed, provide beneficial long term effects.

7. Seed-tree and shelterwood cutting

Direct effects - none

Indirect effects

Seed-tree and shelterwood cutting may indirectly affect RCWs in a number of ways; the impact, to some degree, being a function of the number of entries (typically 2, but sometimes 3) and the number of residual stems remaining after each entry. During the short-term and depending on local foraging habitat availability, these practices may reduce foraging habitat. Conversely, over the long-term, the seed-cut opens the stands and increases the rate of diameter growth on residual stems and thereby provides additional foraging substrate. The substrate may be higher quality than pre-treatment assuming larger, older trees (Jackson and Schardien-Jackson 1986) and increased understory plant community development provide better substrate and production conditions, respectively, for the prey base. Connor and O'Halloran (1987) suggested that shelterwood cuts (and presumably seed-tree cuts with similar stocking) could be used to provide a fast and sustained supply of potential cavity trees based on changes in tree growth rates post-thinning (natural or human-caused). Although Jackson (1982) documented RCWs moving into seed tree cuts he does not recommend them as a management practice for RCWs because of potential competition and predation problems. The final removal of residual trees will produce, from a RCW perspective, very similar conditions and effects as clearcutting. Seed-tree and shelterwood cutting, following the first entries, do not create non-RCW habitat, i.e., a landscape opening. However, the final harvest cut will contribute to landscape fragmentation, with similar effects as clearcutting.

Seed-tree and shelterwood cutting, used as discussed in the EIS and within the required constraints (rotation ages, stand size restrictions, and retention of residual trees in MIL 2), should have no adverse affects on RCWs.

8. Irregular shelterwood cutting

Direct effects - none

Indirect effects

During the first 1-2 entries, the effects of the irregular shelterwood system will be the same as those discussed for the initial entrys for seed-tree and shelterwood cutting; i.e., no fragmentation, and retention of some foraging substrate. Significantly however, irregular shelterwood cutting requires permanent retention (except in MIL 1) of residual trees (the number dependent upon MIL and tree species) and therefore does not produce the negative effects associated with a final harvest removal. Connor, et al. (1991) found that RCWs preferred residual trees as cavity trees in seed-tree and shelterwood cuts over similar aged and sized trees in an adjacent uncut mature forest. They concluded that when stand regeneration is necessary the irregular shelterwood system would benefit RCWs by providing suitable nesting habitat. This silvicultural system should not interfere with normal dispersal or daily movement patterns of RCWs nor increase exposure to predation.

Irregular shelterwood cutting, applied in MILs 1, 2, 3, & 4 and following required constraints (including rotation ages, stand size limitations, residual BAs and/or trees/acre, and leave-tree priorities) should have positive affects on RCW populations.

9. Group selection cutting

Direct effects - none

Indirect effects

Group selection silviculture will create a landscape mosaic composed of small (1/4-2 acre) patches ranging in age from 0-120 (for longleaf) years old. Within patches, although trees may be the same age, they will not be the same size because of the effects of competition from the adjacent older trees. From both a stand and landscape perspective, RCWs should benefit from what will essentially be a continuous forest cover; albeit patchy and of various ages (sizes). Potential cavity trees will be well distributed across the landscape. Similarly, foraging habitat, while not available on every acre (if the average patch size was 2 acres), will be well distributed throughout the landscape. Because of the small size and scattered distribution of the regeneration patches there should be no adverse effects from landscape fragmentation.

Group selection, applied as discussed in the EIS, should provide a reliable means, particularly in longleaf pine forests, of supplying adequate quantities of good quality RCW nesting and foraging habitat through time on all acres where it is practiced.

10. Single tree selection cutting

Direct effects - none

Indirect effects

Because there are few examples, if any, of landscapes where regulated single tree selection has been used as the primary silvicultural system for any significant period of time, the effects of this action on RCW habitat/populations are difficult to qualify or quantify. In general, single tree selection silviculture would provide continuous forest cover and thus, potential nesting and foraging habitat across any stands or landscapes where it is applied. Although trees per unit area will be fewer than with even-aged silvicultural systems, within stand diversity (tree size and age) will be maximized, providing considerable variation in both potential nesting and foraging habitat substrate. However, several factors suggest that single tree selection may be difficult to implement and may not provide optimal habitat for RCWs. These factors include: (1) intolerance to competition, especially with longleaf pine, (2) difficulty in prescribed burning, especially in loblolly and shortleaf pine, (3) development of a pine midstory, (4) poor and/or slow establishment and growth of younger age classes, and (5) the possible need to use more intensive cultural treatments, i.e., herbicides, for controlling competing vegetation and midstory. A significant benefit to single tree selection is that it does not cause landscape fragmentation and therefore will not negatively affect RCW dispersal opportunities or increase exposure to predation.

Although many questions and issues remain unanswered and/or unresolved regarding single tree selection, when applied in longleaf forests, it should provide and sustain adequate quantities of RCW nesting and foraging habitat.

(9) Monitoring

1. Population monitoring

Direct effects

Population monitoring as specified in the EIS involves five different programs; one requires handling of nestlings and/or adults. Direct effects of this action include injury and

death to nestlings and adults. Destruction of eggs is also possible during nest monitoring activities. Nestlings are vulnerable while being: (1) removed from, and placed back into, the nest cavity, (2) transported to the ground and back up the tree, (3) handled and banded during the banding process. Adults are vulnerable while being: (1) trapped in, and removed from, capture nets, and (2) handled and banded during the banding process. Disturbing nesting, incubating or brooding RCWs or disrupting feeding schedules during nestling tending may result in nest failures or nestling deaths.

Indirect effects

Population monitoring will have indirect positive affects on RCWs by disclosing population size and trend information, which in turn requires actions associated with maintaining or changing (increasing or decreasing) the level of habitat management and population monitoring. The effects of these actions are discussed throughout the "Effects of the Action" section of this biological opinion; see in particular **(8) Habitat Management Within HMAs**. Indirect adverse effects are also possible during "group check" monitoring. Roosting (observing RCWs from close proximity as they prepare to "go to roost"), following, and closely observing RCWs for extended periods of time, can disturb them. These actions can result in "open-roosting" for an evening (with potential exposure/predation problems), increased energy expenditure during avoidance behavior, and disruptions of normal behavioral patterns, with unknown consequences. Population size and trend, group survey, and problem identification monitoring should have little or no adverse indirect affects on RCWs.

2. Habitat monitoring

Direct effects - none

Indirect effects

Habitat monitoring will have indirect positive affects on RCWs by evaluating current adequacy of nesting and foraging (particularly nesting) habitat. This information will in turn be used to schedule and implement actions to correct, improve, or maintain suitable habitat conditions. The effects of these actions are discussed throughout the "Effects of the Action" section of this biological opinion; see in particular, **(7), Management of Clusters, Replacement, and Recruitment stands.**

(10) Southern Pine Beetle Hazard Reduction

Direct effects - none

Indirect effects

SPB hazard reduction involves thinning forest stands. The effects of this action are disclosed in **(8) 5., Thinning**; see also **(6) 7., Southern pine beetle suppression.**

(11) Clearing for Nontimber Management Purposes

Direct effects -none

Indirect effects

Clearing forested habitat for mineral exploration or development, roads, utility rights-of-way, recreation facilities, etc. usually requires total and permanent removal of the forest overstory. Permanently cleared land is unsuitable RCW habitat and thus reduces the lands capability to support RCWs. The habitat fragmenting affects of permanent openings may also adversely affect RCWs; see **(8) 6., Clearcutting** for details. The constraints discussed in the EIS will minimize adverse affects of permanent clearings.

Cumulative Effects

Cumulative effects include the effects of future, State, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed actions are not considered in this section because they would require separate consultation pursuant to section 7 of ESA.

Future actions within, and adjacent to, the Forest Service units covered in this biological opinion, such as urban development, road building, land clearing, short rotation logging, and other associated activities may all continue to degrade and eliminate RCW habitat, contributing to further isolation of populations. These activities are anticipated to continue along with some level of RCW population declines previously discussed on private and state lands (see **STATUS OF THE SPECIES**; Status and Distribution; **Rangewide Trend**). However, no State or private lands were considered in the environmental baseline for this consultation. Consequently, the Service did not identify any State or private activities that are reasonably certain to occur within the action area that would contribute as cumulative effects to the proposed action. However, because the Service recognizes and acknowledges that these types of State and private activities will continue in and adjacent to individual populations

within the action area, cumulative effects will be reconsidered during consultation on individual Forest land and resource management plan revisions/amendments.

<u>Discussion of Significant Issues</u>

Status and Trends of RCW populations

Until very recently, with a few notable exceptions and since reliable record keeping began in the mid-1980's, RCW populations within the action area have been declining or, at best, remaining stable, albeit precariously small. Today, 7 populations (2 recovery and 5 support) are on the brink of extirpation, each harboring 5 or fewer active clusters. Additionally, 11 more populations (3 recovery and 8 support) each harbor only 6-50 active clusters. These small populations are vulnerable to extirpation from demographic and stochastic events (Shaffer 1981; Shaffer 1987; Gilpin and Soule 1986; Goodman 1987a). Indeed, 5 RCW populations have been extirpated within the action area; Uwharrie NF (1970's), Sumter NF (1985), Tuskegee NF (1985), Tombigbee NF (1970's), and the Caney Ranger District, Kisatchie National Forest (1986) (Costa and Escano 1989).

According to the latest information available (unpubl. USFS data), covering the period from 1988-1993, 6 (22%) populations are increasing, 16 (59%) appear stable, and 5 (19%) are declining. Of the 12 recovery populations, 4 (33%) are increasing, 7 (58%) appear stable, and 1 (9%) is declining. While population trends appear to be improving since the 1980's, the small sizes of the majority of the populations (18 [67%] of the 27 harbor <50 active clusters) continue to raise serious concerns about their long term stability and viability.

RCW Population Declines

Based on our current understanding of RCW populations, their decline, and in some cases extirpation, can be attributed to several factors. These factors, usually interacting cumulatively and over a period of years, reduce the population's size; increase its variability; and reduce its stability by increasing its sensitivity, and decreasing its resilience to disturbances. In turn, the nature and proximity of the disturbance(s), in conjunction with its timing, duration, frequency, intensity, and severity all influence the magnitude of the impact (e.g., rate of decline) on the population.

The major habitat factors contributing to RCW population declines include: (1) encroachment of hardwood midstory in clusters (Hopkins and Lynn 1971; Van Balen and Doerr 1978;

Locke et al. 1983; Hovis and Labisky 1985; Conner and Rudolph 1989), (2) timber management practices that eliminate/fragment RCW habitat/territories (particularly in small populations) (Connor and Rudolph 1991a), and (3) inadequate supplies of suitable potential cavity trees in many populations (Costa and Escano 1989; and Krusac and Dabney 1994). Characteristics of the species ecology and/or specific populations also suppress population growth and thereby contribute to population declines. These characteristics include: (1) a likely fitness advantage afforded by a stay-and-foray rather than a depart-and-search strategy (Walters et al. 1992a; and 1992b), (2) demographic isolation, and (3) population size and distribution (density) (Connor and Rudolph 1991a; Hooper and Lennartz, in press; and Beyer et al., in review).

RCW Population Increases

Halting and reversing RCW population declines and facilitating increases in stable populations in the action area will demand organized and expeditious implementation of various actions discussed in the EIS. Indeed, several populations have been "turned-around" and have slowly increased for the past 4-5 years (see **STATUS OF THE SPECIES:** <u>Status and Distribution</u>; **Rangewide Trend**). Various population units have, during the short-term, overcome the limiting factors and obstacles that contribute to the decline of small populations. The success of their actions have been dramatic in some cases, e.g., increasing a population from 1 group to 17 groups in 8 years (Savannah River Station, Edwards pers. comm.) or doubling a population from 16 active clusters to 32 active clusters in 7 years (Noxubee NWR, Richardson pers. comm.). Current evidence strongly suggests that RCW population declines can be stabilized and reversed by: (1) eliminating hardwood midstory in active clusters, and (2) establishing new clusters by installing artificial cavities (Connor et al. 1995). Translocating RCWs to single bird groups and/or newly provisioned clusters can increase population expansion rates (Rudolph et al. 1992; Costa and Kennedy 1995). These actions, conducted during the next 10-40 years on National Forests, should have the beneficial effect of increasing the size, density, stability, and viability of RCW populations.

Habitat Management Areas

The designation of HMAs from 6,150 to 150,000 acres in size will provide substantial opportunities to integrate landscape-scale, ecosystem-driven management programs with: (1) RCW recovery requirements, (2) conservation efforts for other rare and/or Federally protected southern pine ecosystem associates, and (3) long-term sustainability of other forest

values.

Future Nesting Habitat

Developing, and maintaining the forest structure and composition necessary for RCW populations to be self-sustaining will require time and significant habitat restoration efforts. The need to provide for, and sustain, future nesting habitat requires that some commonly accepted, standard silvicultural practices either be eliminated as options in most populations or significantly modified. The silvicultural actions, by MILs, discussed in the EIS should foster creation of the landscape attributes required by the RCW; i.e., older trees for RCW cavities, minimum fragmentation, good distribution of nesting and foraging habitat, open park-like, midstory-free forests, and the right tree species on the right site.

The combined effects of increased rotations; retention of residuals/relicts in regeneration stands and in thinnings; establishment of replacement and recruitment stands; and retention of the oldest 1/3 of the pine acres until they reach rotation age, will all help ensure that sufficient quantities of existing and future potential cavity trees are guaranteed during the next several decades and beyond.

Rotation Ages

Recent findings by Clark (1992a, 1992b) indicated that the average co-dominant loblolly and longleaf pine on all sites sampled contained sufficient heartwood at age class 80 and 90/100, respectively, for RCW cavity excavation. In addition, abundant evidence regarding RCWs use of pines with redheart disease (Ligon 1970; Jackson 1977; Connor and Locke 1982; Hooper 1988; others); the cavity tree data presented in Table 4; and the need to retain pines <u>beyond</u> the time they are suitable for RCW cavities (if population expansion/maintenance is the objective) support establishment of 100 and 120 year rotations for loblolly/slash and longleaf/shortleaf, respectively. Findings and management recommendations by Connor and O'Halloran (1987); Connor and Rudolph 1989; and Connor et al. (1994) support both the 120-year rotation age, and the seed tree/shelterwood with residuals and irregular shelterwood silvicultural systems specified in the EIS for MILs 2, 3, and 4.

Additionally, findings by Jackson (1982) indicate that RCWs will establish clusters in seed tree stands. If, as suggested by Delotelle and Epting (1988) and Rudolph and Connor (1991), RCWs preferentially select the oldest trees from a pool of potential cavity trees increasing in age, then the strategies outlined in the EIS, and discussed above,

should provide in perpetuity, a reliable and continuous supply of what Walters (1990), and Walters et al. (1992b) have suggested is the RCWs critically limiting resource, the cluster and associated cavity trees.

Landscape Fragmentation

With the exception of off-site restoration acres, additional landscape fragmentation, resulting from regeneration of mature, non-off-site species, will be limited during the next 20 years. Following is a table illustrating when Forests (HMAs) can begin regeneration harvesting in their non-restoration acres.

Table 5: Estimate of the Number of HMAs by 5-Year Periods (1995-2015) That Can Regenerate Non-Restoration Acres.

5-Year Period	# of HMAs/RCW Populations
1995-2000	13
2001-2005	3
2006-2010	7
2011-2015	1
2015+	3
Total	27

As Table 5 illustrates, numerous National Forests in the action area will not be conducting non-restoration regeneration harvesting for the next 10 years. Additionally, until individual populations are recovered, all regeneration harvests require retention of residuals; effectively eliminating/minimizing any potential adverse effects of fragmentation. Rudolph and Connor (1994) have recently hypothesized that fragmentation may reduce the success of dispersing juvenile females locating potential breeding vacancies, thereby increasing the number of groups failing to breed, thus reducing average group size, resulting in lost reproductive potential. Twenty-five of the 27 Forest Service populations (none identified on the Oconee or Cherokee National Forests) have identified approximately 401,182 acres of off-site pine that will be restored to native pine species, primarily longleaf. A significant percentage of these acres are in the older (>30 years) age classes discussed in **ENVIRONMENTAL BASELINE**, Status of the Habitat. Regenerating these acres will contribute to fragmentation, but adverse impacts will be minimized by following restrictions specified in the Pine Restoration discussion of Alternative E.

Only one recovery unit, the Apalachicola RD, is considered recovered. This population will be managed under MIL 1. A

significant silvicultural difference between MIL 1 and MILs 2, 3, and 4 is that when even-aged management is used, permanent retention of residual trees is not required in regeneration stands; regeneration stands can also be 40 acres in size, compared to 25 in other MILs. While clearcutting is not permitted in mature stands under MIL 1, the removal of seed trees or shelterwood trees (their removal is not required, but an option) after successful seedling establishment, will essentially create a clearcut.

A negative fragmentation effect from small to moderate size regeneration units has not been demonstrated for reasonably healthy woodpecker populations (Wood et al. 1985; Hooper and Lennartz, in press). For example, a 10-fold increase in the fragmentation index in one study was accompanied by a 30% increase in the number of groups (Hooper and Lennartz, in press). Also, the 10% increase in the population on the Francis Marion National Forest (to a recovered level prior to hurricane Hugo) occurred during the same period that the Forest experienced its highest level of timber harvesting (Hooper et al. 1991a). In all likelihood, the best National Forest populations today (Apalachicola RD, Vernon RD, and Francis Marion NF) were considerably smaller in number in the 1930's following the removal of the oldgrowth forest and have subsequently increased to their current levels; these increases have occurred even though these 3 Forests have had even-aged based timber programs for the past 30 years (Hooper, pers. comm.). Also see discussion concerning current conditions of RCW population/habitat on the Apalachicola RD, in section **(8) 4., Establishing rotations.**

AS previously noted, there is some evidence that fragmentation has a negative effect in low density, sparse populations (Kalisz and Boettcher 1991; Connor and Rudolph 1991a; Rudolph and Connor 1994; Hooper and Lennartz, in press; Beyer et al., in review). However, these potential negative effects are protected against by the management requirements for MILs 2, 3, and 4, where population numbers and/or densities are or may be low.

Hardwood Midstory

The ongoing Forest Service hardwood midstory control program in nesting habitat is one of the key elements in both the short and long term RCW recovery initiative. At this time, all active clusters have had their midstory hardwoods eliminated. However, all designated nesting habitat (replacement and recruitment stands) has not been treated. Completion of this task, in conjunction with installation of artificial cavities, and commensurate with expected rates of population growth, will ensure that RCW populations, regardless of their size, will have opportunities for

expansion.

Artificial Cavities

Installation of artificial cavities has proven to be a very effective means to both stabilize and expand RCW populations, even very small ones. Well planned and aggressive use (commensurate with the population's expected rate of response; a function of its size, distribution, and variability) of this management tool, during the next 30+ years, will be required to move most RCW populations toward recovery.

RCW Translocations

RCW translocations will be necessary to save most, if not all, of the very small (<15 active clusters; N=10, 37%) remaining RCW populations. Additionally, 8 other populations harbor fewer than 50 active clusters and will benefit from RCW translocations. The Forest Service, in close coordination with the Service, must continue to implement and improve its 6-year old translocation program, if these small populations are to be saved.

Prescribed Burning

Prescribed burning, over the long-term, will provide the foundation for both restoration and maintenance of the southern pine ecosystem (particularly longleaf pine forests) upon which the RCW depends. Fire, more than any other natural disturbance, influenced the ecological processes today associated with the species rich southern pine ecosystem. Reintroduction of this disturbance, via prescribed burning and primarily during the growing season, will be an important factor in maintaining the sustainability of RCW habitat. Prescribed burning, used effectively, is the most efficient and "natural" way to maintain RCW habitat (nesting and foraging) in optimal condition.

Foraging Habitat

Current foraging habitat standards for Federal lands (see Henry 1989) will remain in place in the action area. These standards, with everything else being equal (i.e., cavities available, midstory controlled, etc.), have proven sufficient to maintain and/or increase RCW populations. Modifications of the foraging habitat guidelines will be considered by the Service on a population-by-population basis. If specific recovery/support unit information indicates RCW populations require more, or can thrive on less, foraging substrate, changes in the standard for that population will be considered through consultation with the Service. Changing

foraging habitat guidelines will require, as a minimum: (1) an increasing population trend (stable if recovered), (2) multiple-year analyses regarding the population's fitness in relationship to habitat quality and quantity, and (3) analyses/consideration of how changing the guidelines will influence other landscape attributes (i.e., fragmentation) considered to have potential adverse affects on achieving or maintaining recovery status.

Monitoring

Population and habitat monitoring are required to measure the effectiveness of the RCW recovery program in the action area. Assessing change over time must be an integral component of the RCW management program if progress toward recovery is to be evaluated. During Forest land and resource management plan revisions/amendments, individual populations will be evaluated to determine an expected rate of population increase; given population size, distribution, variability, and, if available, known rates for other similar size populations.

MIL 1 and the Apalachicola Ranger District RCW Recovery Population

The Apalachicola RD RCW population is the only population currently considered to be recovered. Therefore, it will be the only population of the 27 action area populations managed under MIL 1. Given the precarious status of the species rangewide, and the value of the Apalachicola RD as a contributor to the species recovery, the Service believes that the management direction provided in MIL 1 is necessary to sustain the vigor, and maintain the value, of this important recovery unit.

The Apalachicola RD RCW population has, since the inception of the regional RCW translocation program (Hess and Costa, in press), been the foundation for the program's success. During the period 1989-1994, 143 RCWs were translocated within the action area (Costa and Kennedy 1995); 52 (36%) of these birds originated on the Apalachicola RD and were translocated to 13 different populations in 6 states. While the Apalachicola RD's role in the regional translocation program will be scaled back somewhat in the coming years, it will remain vitally important as the best reliable source of birds; and could, depending on extenuating circumstances again be called on to be the primary supplier of juvenile RCWs.

The Apalachicola RD RCW population, like many other recovery populations, is vulnerable to the destructive forces of hurricanes (Hooper and McAdie, in press). The impact of

hurricane Hugo on the recovered (pre-Hugo) Francis Marion National Forest RCW population has been well documented (Hooper et al. 1990). Similarly, the short-term restoration of that population post-Hugo has also been documented (Watson et al., in press). One of the rationales for establishing multiple RCW recovery units was to ensure that the "loss" of one or more RCW recovery populations, resulting from natural catastrophes potentially occurring over several decades, does not jeopardize the continued existence of the species. Given that today, only one of the required 15 recovery populations is recovered, and we have a better understanding of how and to what degree RCW populations can be impacted by hurricanes, it is critical that the Apalachicola RD population be managed and protected in a manner consistent with its key role in RCW recovery.

As the only recovered population, it also provides the sole source for research opportunities and implementation of adaptive management strategies in a large population. Understanding this large population's response to landscape changes will provide the foundation of knowledge necessary to successfully grow and sustain viable RCW populations. Additionally, this population will provide an opportunity to assess the demographic effects of removing a relatively small percentage of birds (primarily juveniles) annually. Additional monitoring, research, and management opportunities that can be conducted nowhere else, should be thoughtfully explored, considered, and if deemed appropriate (i.e., no adverse effect on the population) encouraged on the Apalachicola RD.

In conclusion, considered alone, the Apalachicola RD recovery unit is relatively healthy and perhaps capable of sustaining some level of continuing landscape impacts, perhaps beyond that which will be imposed by MIL 1, before the species in the recovery unit is jeopardized. However, because this recovery unit is: (1) the only 1 of 15 considered recovered, (2) a major source of individuals for ensuring the survival of other recovery units, (3) the sole source for research and management opportunities in a large (recovered) population, and (4) vulnerable to significant "loss" from hurricanes, any loss of reproductive capability in this recovery unit could represent jeopardy because the conservation of the entire species would be significantly impaired. This jeopardy standard, i.e., loss of reproductive capability, applies not only to the Apalachicola RD, but to all of the 14 recovery units established for this species.

Summary

In conclusion, the Forest Service RCW strategy, promotes recovery of the RCW by requiring implementation of a

conservation strategy based, in part, on some principles of ecosystem management. The EIS promotes practices that: (1) minimize landscape and habitat fragmentation, (2) retain suitable numbers of potential cavity trees well distributed throughout the landscape, and (3) restore the original forest cover by reestablishing the appropriate pine species, primarily longleaf. The strategy requires the use of prescribed burning, emphasizing growing season fires, to control hardwoods, create open forest conditions, and begin to restore the diverse understory plant communities associated with today's healthy RCW populations. Stabilization and growth of small, high-risk populations will be aided by creating artificial cavities and translocating juvenile birds from larger, stable populations into small ones. Haig et al. (1993), in reference to their viability studies on the small RCW population at Savannah River Station in South Carolina, suggest that with careful population planning even vulnerable populations may recover; planning must consider short- and long-term effects of environmental, demographic, and genetic stochasticity on the population. In conclusion, RCW recovery in the action area will be dependent upon successfully implementing ecological principles with RCW management--that is, applying the basic concepts of conservation biology (Walters 1991).

CONCLUSION

After reviewing the current status of the RCW, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the RCW; no critical habitat has been designated for this species, therefore, none will be affected.

There is considerable interagency section 7 consultation time savings to be gained, with no loss of necessary biological effects analysis, if future activities that comply with the RCW Strategy and Biological Opinion are processed as follows:

Future projects, including translocation, restrictors, monitoring, prescribed fire, midstory control, timber sales, etc. that are in accordance and compliance with both the RCW EIS Record of Decision and its Biological Opinion, <u>and</u> with those parts of the 1990 Interim S&G (and Service concurrence) that remain in effect, <u>and</u> have a biological evaluation determination of effect on RCW of "not likely to adversely affect," will meet section 7 consultation requirements. If Forest Service project biological evaluations determine a "likely to adversely affect" situation, formal consultation will be necessary. This process would be effective only until the Forest Service regional RCW Strategy is

incorporated into Forest Plans through amendment or revision.

INCIDENTAL TAKE STATEMENT

Sections 4(d) and 9 of the ESA, as amended, prohibit taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without a special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency, i.e., the Forest Service. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

Amount or Extent of Take

The Service anticipates that 47 adults, 3 nestling RCWs, 7 RCW nests (with up to any combination of 28 eggs and/or nestlings) and 10 RCW active cavity trees may be "taken" annually within the action area, as a result of the proposed actions. Regarding adults, 1 may be harmed due to loss of its cavity tree from cutting for southern pine beetle control; 1 may be killed in association with the use of artificial cavities; 1 may be killed/harrassed in association with the use of cavity restrictors; 32 may be lost during translocation efforts; 1 may be killed/harrassed as a result of translocation operations; 10 may be harmed during prescribed burning activities; and, 1 may be killed/harrassed as a result of population monitoring. The "take" associated with the birds "lost" during translocation efforts will be dificult to quantify, since the released birds, if they do not remain at or near the release cluster, are rarely ever seen again. It is assumed that some of the translocation "take" will be by death, and that some of this "take" will be in the form of harass.

"Take" that is intended, including capturing adults and nestlings for monitoring and translocation programs, is not incidental and therefore requires an ESA section 10(a)(1)(A) permit. All other "take", such as that associated with the

disappearance of translocated birds or death of birds caught in restrictors or artificial cavities, is not intended, and therefore classified as incidental and covered by this biological opinion.

Following is a breakdown of anticipated "take" by activity; the direct effects of these actions are discussed in the **ENVIRONMENTAL BASELINE**; Effects of the Actions:

(6) 1. Cutting
1 adult harmed (loss of active cavity tree)

(6) 4. Nesting season disturbance
no take anticipated

(7) 6. Artificial cavities
2 nests destroyed (with associated loss/death of eggs and/or young [n=8 maximum])
1 adult killed

(7) 7. Cavity restrictors
1 adult killed/harassed

(7) 8. Translocation
1 adult killed/harassed (handling)
32 adults killed/harassed (lost at recipient site)

(8) 1. Prescribed burning
10 adults harmed (loss of active cavity tree)
5 nests destroyed (with associated loss/death of eggs and/or young [n=20 maximum])

(9) 1. Population monitoring
1 adult killed/harassed
3 nestlings killed

The above estimates of incidental take are based on: (1) data supplied to the Service by the Forest Service in annual reports from 1992-1994, and in personal communications during 1995, (2) known causes of death/injury to RCWs from Federal/State/private actions identical or similar to those planned by the Forest Service, and (3) expected increases in the number of: (a) birds handled/banded/translocated, (b) artificial cavities and restrictors installed, and (c) acres burned, as the EIS is implemented.

In 1992, within the action area, 1 adult RCW was killed (apparently by a raptor) while caught in a mist net; 1 adult died as a result of being trapped in pine resin that leaked into an artificial cavity; and 2 banded nestlings were found dead in their cavities approximately 2 weeks after being banded.

In 1993, within the action area, no known nestling or adult RCWs were injured or killed as a result of handling or other associated management activities, i.e., installation of artificial cavities.

In 1994, within the action area, 1 adult RCW was injured, and subsequently died, while an improperly placed (wrong leg) band was removed; 1 nestling was killed while being transported down the cavity tree (it was crushed between the ladder and the biologists leg; 1 nestling suffered a broken leg while being noosed from cavity (splint was applied, chick fledged, and was still with group in fall); 5 nestlings (2 nests) died as a result of a summer wildfire that burnt their nest trees, illustrating that unprotected cavity trees could result in nestling mortalities during prescribed burning operations.

To date in 1995, 2 adult RCWs have died of unknown causes after being translocated from a donor population to a recipient population. The birds, although apparently healthy and well fed during the translocation process, died for unknown reasons.

The following table summarizes RCW translocations from 1989-1994.

Table 6: RCW Translocations, 1989-1994

Year	Total Number Translocated	# "Taken" (%)
1989/90	20	6 (30%)
1990/91	13	4 (31%)
1991/92	22	8 (36%)
1992/93	30	12 (40%)
1993/94	68	31 (45%)
Total	153	61 (40%)

Based on the information provided above, the Service estimates that approximately 40% of RCWs translocated will be incidentally taken. Although the trend of birds not seen again increased from 1989 to 1994, the preponderance of "lost" birds in 1993/94 resulted from attempts to establish new breeding pairs by translocating males and females to "new" clusters. Numbers of "taken" birds are considerably lower (27%) for translocations involving moving a juvenile female to a single male with a territory, the most common translocation made until 1993/94 when many attempts at establishing pairs were made (Costa and Kennedy 1995).

The Service has recently established new guidelines (i.e., restrictions) for attempts to "create" new breeding pairs at

new, unoccupied clusters; e.g., limitations on the number of populations involved, more intense monitoring requirements, involvement of researchers, etc. These measures should minimize the loss of birds involved in this type of translocation; while providing information, and establishing procedures, to increase success rates of this very important recovery program. Currently, the Forest Service is authorized (Endangered/Threatened Species Subpermittee Authorization #SA 94-42, Renewal SA 93-16) to translocate 80 male and/or female juvenile RCWs per year. At a 40% potential loss rate, up to 32 RCWs may be incidentally taken.

In addition to the losses documented in annual reports, the Service is aware that RCW nests and active cavity trees have been lost on National Forests during prescribed burning operations. As recently as April 1995, 3 nestlings were killed during a prescribed burn on a military installation. At least one RCW has been caught in a restrictor and later died of its injuries.

The Forest Services' annual reports and the Services' anecdotal information regarding effects of the listed actions on RCWs, in conjunction with the other factors previously noted, support the annual estimate of incidental take anticipated.

Effect of the Take

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species.

Reasonable and Prudent Measures

The measures described below are non-discretionary, and must be implemented by the agency so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in section 7(o)(2) to apply. The Forest Service has a continuing duty to regulate the activity covered by this incidental take statement. If the Forest Service (1) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of RCWs.

(1) All personnel trapping, banding, transporting, feeding, or otherwise handling RCW eggs, nestlings, and/or adults will be properly trained and certified to do so by experienced individuals. Experienced individuals are those that have performed the activity in question: (a) for multiple years, (b) with many (50+ nestlings **and** adults; except for transporting/feeding) birds, and (c) in varied situations and under different environmental and ecological conditions. Individuals who have not been previously involved with transporting and feeding RCWs will, prior to transporting birds, communicate with Service's RCW Coordinator regarding translocation procedures.

(2) All personnel installing artificial cavities (inserts and drilled) will be properly trained and certified [see **Terms and Conditions** (6)(d)] to do so by experienced persons. Experienced persons include any of the following: those that; (a) developed the techniques, (2) have successfully installed at least 15 inserts, and (c) have successfully installed at least 25 drilled cavities. Additionally, all personnel installing artificial cavities will read about, and be familiar with, the techniques as described by the developers, (Copeyon 1990; Allen 1991; Taylor and Hooper 1991).

(3) All personnel designated to install cavity restrictors must first read, and then follow the recommendations in, "Restrictors for Red-cockaded Woodpecker Cavities" (Carter et al. 1989).

(4) The following specific measures are necessary to minimize and/or eliminate the take that has been associated with past RCW activities in previous years:

(a) no nets, used to trap adult RCWs, will be left unattended.

(b) all nestlings will be lowered to the ground and raised to the cavity, in an appropriate container (soft bag); they will not be transported up-and-down the ladder with the biologist.

(c) improperly "placed" (wrong position or wrong leg) leg bands (Service aluminum or colored plastic) will not be removed once in place. Bands improperly "attached", and thus potentially causing injury, may be removed and replaced if necessary and prudent (i.e., no permanent injury resulted from attaching or removing the band).

(d) all active cavity trees will be protected from fire during prescribed burning operations. Protection may involve any number of methods including, but not limited to: (1) raking around or back firing from the base of

the tree, (2) using a "wet" line or foam line around the tree or entire cluster, and (3) mechanically removing vegetation. All active trees lost or any active cavities destroyed by prescribed fire will be replaced within 48 hours by installing the appropriate number of artificial cavities, weather permitting.

(e) all active cavity trees cut for public safety or insect infestation reasons will be replaced, prior to cutting of the cavity tree, by installing artificial cavities in the closest, acceptable tree to the cavity tree being removed. Active nest (eggs/nestlings) trees will not be cut, except in extenuating circumstances (to be discussed and evaluated at the time); consultation with the Service will be required.

(5) During the nesting season (egg laying to fledging young), personnel will minimize the time spent within active clusters, and particularly within 200 feet of the nest tree, for the purpose of monitoring reproduction, banding young/adults, and other associated activities.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of ESA, the Forest Service must comply with the following terms and conditions (1-10), which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

(1) All conditions, reporting requirements, and related responsibilities as specified in the Forest Service's Endangered/Threatened Species Subpermittee Authorization #SA 94-42, Renewal SA 93-16, and in the Forest Service's subpermit issued under the Service's Region 2 Regional Director's blanket U.S. Fish and Wildlife Service Endangered Species Permit PRT-676811 and Master Migratory Bird Permit PRT-678718/701308, will be followed; above holds true for subsequent renewals of these subpermits.

(2) A copy of the above authorization will be distributed to, and carried by (in the field), all individuals involved with any of the activities discussed in the Incidental Take section of this Biological Opinion.

(3) A list of "certified" persons (i.e., the trainers), in reference to items # 1 and 2 in the reasonable and prudent measures, will be included in the Forest Services' annual report to the Service.

(4) The most experienced "translocation" biologist will be identified in the Forest Services annual report to the Service.

(5) The list of certified subpermittees by activity, i.e., drilled cavity installation, will be provided in the Forest Services' annual report to the Service.

(6) The following minimums are required before subpermittees will be considered qualified and thus, "certified" to perform the specified activity(ies) on their own:

(a) Banding nestlings: noose and band the young of 5 nests, but not less than 10 nestlings.

(b) Banding adults: net, extract from the net, and band 10 adults.

(c) Transporting/feeding adults: In addition to discussing the procedures with the Service's RCW Coordinator, first time translocation biologists will be accompanied, during the move, by at least one individual who has transported RCWs before.

(d) Installing drilled cavities: install at least 5 drilled cavities and 2 drilled starts.

(e) Installing cavity inserts: install at least 3 cavity inserts.

(7) Within 6 months of the date of this Biological Opinion, the Forest Service will provide draft translocation guidelines (transporting procedures, transport box design/construction, food types, feeding schedules, etc.) for Service review and concurrence. The Service will work with the Forest Service on development of these draft guidelines if requested to do so.

(8) To assure adequate action agency oversight of any incidental take resulting from the activities listed above (see **Amount and Extent of Take**) the following monitoring requirements will be implemented:

(a) Installing drilled cavities: All drilled cavities will be maintained according to the schedule provided on pages 19-22 of "A Modification of Copeyon's Drilling Technique for Making Artificial Red-cockaded Woodpecker Cavities (Taylor and Hooper 1991). The Forest Service will annually report the total number of drilled cavities installed and the number that leaked (any time during the maintenance examinations).

(b) Installing cavity inserts: With the exception of those installed to mitigate the loss of an active cavity (i.e., SPB, hurricane, or fire loss) all cavity inserts installed in clusters and recruitment stands will be screened for 2 weeks; then inspected to ensure that the insert was not cracked during installation causing resin to leak into the roost chamber. Total number of cavity inserts installed along with the number that leaked will be reported annually.

(c) Cavity restrictors: The total number of cavity restrictors installed by population will be reported annually. All cavity restrictors will be monitored the evening of the day they are installed. If the resident RCW will not enter the cavity after a reasonable period of time, apparently because of the restrictor, the restrictor will be adjusted and/or removed. Adjustment and/or reinstallation past normal roosting hours may disrupt behavior patterns and cause open-roosting; therefore, such measures will be delayed until the following day if necessary. All cavity restrictors will be installed and adjusted pursuant to the guidelines published by Carter et al. (1989).

(d) Translocation: The disposition of all translocated birds will be reported to the Service with an annual "Translocation Report". The Forest Service will monitor all translocated birds according to the following schedule:

(1) On the morning of release, observe birds until they leave vicinity of the cluster. Return that evening to do a roost check. If both birds return the first night, recheck status in 5-7 days. If still present, check in 1 month; if still present, schedule group for breeding season monitoring, including monitoring of eggs, nestlings and fledglings.

(2) If the released bird does not return first night, recheck status the following morning and/or evening. If bird is still not present after second day, recheck status at 5-7 day intervals for the next month. If bird returns, recheck status in 5-7 days, and then follow schedule above [(8)(d)(1)]. If after 1 month bird is not present, recheck 2-3 times during the breeding season (mid-April through early June. If the bird is present during the breeding season, implement the breeding season monitoring schedule.

The annual Translocation Report currently submitted by the Forest Service is sufficient for recording the disposition of translocated RCWs. However, following the above monitoring program will increase the accuracy of the findings regarding the success or failure (i.e., take) of each translocated bird. This information is critical for assessing the level of incidental take and making adjustments in, to increase the success of, the translocation program.

(e) Prescribed Burning: The total number of active clusters prescribed burned will be reported annually. The number of active cavity trees and active cavities destroyed by prescribed burning will also be reported, along with any known losses of nest cavities/eggs/nestlings. The number of artificial cavities installed to replace the losses will also be reported.

(f) Population monitoring: The total number of: (1) nests monitored, (2) nestlings handled and banded, and (3) adults trapped and banded, will be reported annually by population.

(9) To ensure that the level of authorized incidental take is not exceeded, any injury and/or death of RCWs (including, nests with eggs/nestlings; nestlings; and adults) or loss of active cavity trees, will be reported to the Service's RCW Recovery Coordinator and the Service's Regional Permit Coordinator within 72 hours.

All specimens, except those found in an advanced deteriorated condition, will be salvaged by the Forest Service person(s) finding the RCW(s). Specimens will be: (1) labeled (persons name; location of injury/death, i.e., Forest, district, and cluster; cause of injury/death; date of injury/death; other relevant information), (2) placed in a freezer as soon as possible, (3) held at the location until its disposition has been decided upon by the Service. A brief narrative report, detailing the circumstances surrounding the incident (i.e., active cavity tree loss, injury and/or death of the nestling(s) or adult(s) RCW) will be submitted to the RCW Coordinator within 1 week after the incident. Disposition of any RCW specimens must be coordinated with both the Service's law enforcement division and the RCW Recovery Coordinator.

(10) The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might otherwise result from the proposed action. With implementation of these measures the Service believes that no more than the following number of RCWs and active cavity trees will be incidentally "taken" annually: 47

adult RCWs killed/harassed/harmed (see **Amount or Extent of Take** for details); 3 nestlings killed (handling); 7 RCW nests, with up to 28 eggs and/or nestlings destroyed; and 10 active cavity trees destroyed. If during the course of the action, any of the levels of incidental take authorized for specific activities is exceeded, such incidental take represents new information requiring review of the reasonable and prudent measures provided and reinitiation of consultation with the Service. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of ESA directs Federal agencies to utilize their authorities to further the purposes of ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or develop information. Although discretionary, the Service recommends that the Forest Service implement the following conservation recommendations:

(1) In an effort to better understand the relationships between RCW populations (size, productivity, density, and growth rate) and their environment, i.e., their response to human-induced habitat and landscape alterations resulting from silvicultural practices (similar to what will occur with Alternative E in the EIS), the Service recommends the establishment of ecosystem reference areas. These areas would have little or no silvicultural manipulation of nesting and/or foraging habitat. Therefore, they would provide a reference point as to what effects implementation of other conservation strategies, i.e., Alternative E, have on recovery rates and RCW population health. The Service recommends that several (3-5) such areas be established; e.g., one for each of the <u>major</u> forest types/physiographic provinces represented in the action area (i.e., longleaf/Atlantic Gulf Coastal, longleaf/Gulf Coastal Plain, loblolly/Piedmont, and shortleaf/Interior Highlands). Ecosystem reference areas should be at least 5,000 acres in size. They should be managed under a scenario similar to, or modified from, Alternative D.

(2) Very little information currently exists regarding the relationships between regulated, uneven-aged silvicultural systems in longleaf pine and RCW management/conservation. Such information could provide important new knowledge regarding RCW population response at a landscape scale, to different, and as yet untested, forest management options. Significantly, this knowledge may be critical, over the long-term, for evaluating the impacts of, and response to, landscape changes brought about by natural events such as hurricanes, fires, etc. The Service recommends that the Forest Service designate and establish several sites (e.g., 3-5, in as many longleaf HMAs) to evaluate these unknown relationships. The areas should have enough acreage to support 25 RCW groups. As an example, the current uneven-aged study on the Apalachicola RD could be expanded and 2-5 other similar projects could be established on several other Forests.

(3) Because of the significant differences between: (1) RCW populations (size, variability, density, etc.), (2) forest types and physiographic provinces, (3) current structure and composition of the pine habitat in Forests, (4) current structure and composition of the understory plant community in Forests, and (5) local ecological communities, the Service recommends that the Forest Service increase its efforts at understanding RCW foraging habitat selection, quality/quantity needs, and maintenance. Administrative studies could include: (1) determining preference for foraging in stands of various ages, sizes, stockings and species composition, (2) determining relationships between quantity and quality of foraging habitat and reproduction, recovery rate, and population dynamics. These studies, by population, could provide the information needed to develop population-specific foraging habitat guidelines.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation on the action(s) outlined in the Forest Service request. As provided in 50 CFR Section 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the

action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Sincerely,

Ralph Costa

Ralph Costa
Red-cockaded Woodpecker
Recovery Coordinator

LITERATURE CITED

Red-cockaded Woodpecker

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Red-cockaded Woodpecker Field Office
Department of Forest Resources
Clemson University
261 Lehotsky Hall, Box 341003
Clemson, South Carolina 29634-1003

IN REPLY REFER TO:

May 19, 1995

BJ
GM
cc: FWTM

Robert C. Joslin
Regional Forester
USDA, Forest Service
1720 Peachtree Road, NW
Atlanta, Georgia 30367

Dear Mr. Joslin:

This letter responds to your request regarding concurrence on your determinations of effect for alternatives A, B, C, and D, as proposed in the red-cockaded woodpecker (RCW) management strategy documented in the environmental impact statement and biological assessment for that strategy. Our recently issued biological opinion on alternative E, the proposed alternative, addresses the effects of that alternative on the listed species affected.

We concur with your determinations of effect for RCWs and other listed species for alternatives A, B, and C. We also concur with your "not likely to adversely affect other listed species" determination for alternative D. However, we do not concur with your determination of "may adversely affect" for RCWs under alternative D.

Essentially, the only difference between alternative D and alternatives C and E, both of which determined beneficial effects on RCWs, is that alternative D does not provide for sustained yield forestry; i.e., with the exception of restoration acres, there is no planned regeneration. All other habitat and population related management/conservation activities are permitted; including, habitat management area (HMA) delineation, management intensity level designation, installation of artificial cavities, translocation of RCWs, prescribed burning, pine restoration, thinning, and monitoring. It is our opinion that under the practices permitted, particularly thinning, restoration, and burning, the forests within HMAs will perpetuate themselves over the long-term and thereby supply RCW habitat through time and space.

The majority (21 of 27) of HMAs exceed 45,000 acres; 6 of the 27 exceed 100,000 acres. Restored HMAs of the above sizes, particularly those that are longleaf dominated and properly managed with selective thinning and prescribed fire, will

provide and sustain habitat conditions favorable to RCWs. Additionally, natural, reoccurring (over the long-term) disturbances (fire, windstorms, etc.) of various scales will create conditions that favor establishment of regeneration. We do not believe that RCW habitat within such large tracts of land will be subject to the "boom or bust" scenario, regarding availability of RCW cavity trees (particularly longleaf pine which can survive 100's of years), that is described in your biological assessment. Human and/or natural induced disturbances would create habitat gaps providing the niches and opportunities for regeneration to become established and grow to maturity. While this alternative will not create a "regulated forest", it should provide (especially in longleaf HMAs), albeit in an "unregulated" environment, vast acreage of forested habitat suitable for RCWs through time and space.

In situations where catastrophic disturbances, such as category 4-5 hurricanes, significantly impact RCW habitat and populations (e.g., Hugo/Francis Marion NF event) the other activities permitted in alternative D, such as artificial cavities and translocations, will minimize the adverse effects of these disturbances on RCWs.

In conclusion, we concur with all of your determinations of effect for all listed species and alternatives except for the "may adversely affect" determination for RCWs with alternative D.

Sincerely,

Ralph Costa

Ralph Costa
Red-cockaded Woodpecker
Recovery Coordinator

cc:
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